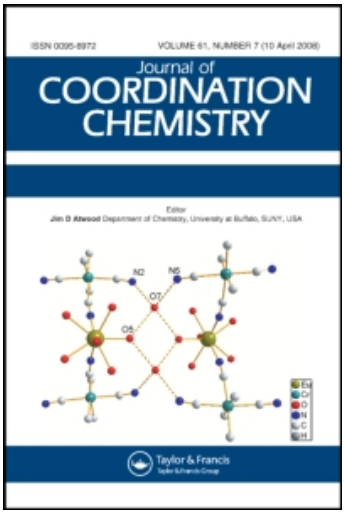

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REVIEW: ZINC(II) COMPOUNDS: CLASSIFICATION AND ANALYSIS OF CRYSTALLOGRAPHIC AND STRUCTURAL DATA

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REVIEW

ZINC(II) COMPOUNDS: CLASSIFICATION AND ANALYSIS OF CRYSTALLOGRAPHIC AND STRUCTURAL DATA

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KEYWORDS: review, zinc, structures

CONTENTS

1. ABBREVIATIONS

ac acetate
acac acetylacetonate

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adc	hydrogenacetylenedicarboxylate
aeaa	α-(N-2-aminoethylamidino)alanine
ahxan	8-azahypoxanthinate
aldtc	diallyldithiocarbamate
amph	aminomethylphosphoniate
apt	1-amino-2-propanethiolate
apy	antipyrine
asp	aspartate
atp	adenosine-5'-triphosphate
atsc	acetonethiosemicarbazone
atu	6-amino-2-thiouracilate
bdda	benzene-1,2-dioxydiacetate
bet	betain
bipam	di-2-pyridylamine
bispicam	bis(2-pyridylmethyl)amine
buf	di-tert-butylnaphthalenesulfonate
bta	(benzylthio)acetate
btsc	(benzylthiosemicarbazone
bpy	bipyridine
Bu	butyl
But-dab	N,N-di-tert-butyl-1,4-diazabutadiene
bztpp	N-benzyltetraphenylporphirinate
cat	catecholate
cbp	3,3'-iminobis(propylamine with 5-chloro-2-hydroxybenzophenone)
cdta	cyclohexane-1,2-diamine-N,N,N',N'-tetraacetate
cmh	cyclo(L-methionyl-L-histidyl)
cmomep	cytidine-5'-monophosphate
crot	crotonate
cys	cysteinate
C_2H_5NS	thioacetamide
$C_2H_6O_2$	1,2-ethanediol
$C_2O_2S_2$	1,2-dithiooxalate
$C_3H_4O_6P$	phosphoenolpyruvate
$C_3H_6O_3$	monoglycerolate
$C_4H_5N_6$	8-azaadeninium
$C_4H_7N_3$	4-ethyl-1,2,4-triazole
$C_4H_8O_2$	1,4-dioxane
$C_4H_8N_2S_2$	N,N'-dimethyldithiooxamide
C_4O_4	squarate
C_5H_4NOS	N-oxopyridine-2-thionate
C_5H_5	cyclopentadienyl
$C_5H_5N_4$	purinium
$C_5H_5N_4O_3$	4-amino-1, 2-dihydro-1-methyl-5-nitroso-2-oxo-6-pyrimidinolate
$C_5H_6NO_3$	oxo-5-prolinate
$C_5H_6N_2S$	1-methylpyrimidine-2-thione
$C_5H_6N_5$	adeninium

C_5H_7	2,4-pentadienyl
$C_5H_7O_2$	acetylacetone
$C_5H_8N_2S$	methylthio-2-methyl-3-imidazole
$C_5H_8N_4O$	2-hydrazino-4-hydroxy-6-methylpyrimidine
$C_5H_9N_2S_2$	S-methyl-isopropylidenehydrazinecarbodithiolate
$C_5H_{10}NCOS$	cyclopentamethylenethiocarbamate
$C_5H_{10}NO_2S$	O-ethyl-L-cysteinate
$C_5H_{13}N_2$	2-dimethylamino-N-methylethylamido
$C_6H_4NO_2$	2-picolinate
$C_6H_5N_3$	benzotriazole
$C_6H_6N_4$	2,2'-biimidazole
$C_6H_7N_5$	9-methyladenine
$C_6H_{11}N_3$	4-tert-butyl-1,2,4-triazole
$C_6H_{12}N_4$	hexamethylenetetraamine
$C_6H_{14}NO$	2-diethylaminoethanolate
$C_6H_{14}NO_3$	triethanolamine
$C_6H_{15}N_3$	1,4,7-triazacyclononane
$C_7H_5S_3$	trithioperoxylbenzoate
$C_7H_6N_2$	7-azaindole
C_7H_7S	4-toluenethiolate
$C_7H_8O_2$	2,6-dimethyl-4H-pyran-4-one
$C_7H_8O_5$	4-oxoheptanediolate
C_7H_9NO	2,6-dimethyl-4-pyridinone
$C_8H_8O_5$	dimethylcantharate
$C_8H_{12}N_2O_3$	2,2,5,5-tetramethyl-3-imidazolyl-1-oxyl-4-carboxylate
$C_8H_{14}N_6OS$	[3-ethoxy-2-oxobutyraldehyde-bis(thiosemicarbazonate)]
$C_8H_{21}N_3$	tris(methylaminomethyl)ethane
C_9H_9NO	benzoylaziridine
$C_9H_9NO_2$	N-salicylidene ethanolaminate
$C_9H_9N_2S_2$	S-methyl-benzylidenehydrazinecarbodithiolate
$C_9H_{11}N_3O_2$	2,6-diacetylpyridine dioxime
$C_9H_{13}N_2$	N-(2-pyrrolylmethylene)-tert-butylamine
$C_{10}H_5NO_5S$	1,2-naphthoquinone-2-oximato-5-sulfonate
$C_{10}H_8NS$	2-mercaptomethylquinolinate
$C_{10}H_9O_2$	benzoylacetonate
$C_{10}H_{10}N_2$	3-methyl-5-phenylpyrazole
$C_{10}H_{12}O_2S$	2-methyl-2-(phenylthio)propanolate
$C_{10}H_{15}N_3$	1-(2-pyridyl)-2,5-diaza-5-methyl-hexa-1-ene
$C_{10}H_{16}N_2$	N,N,N',N'-tetramethyl-o-phenylenediamine
$C_{10}H_{20}O_5$	pentaoxa-1,4,7,10,13-cyclopentadecane
$C_{10}H_{34}N_4$	1,4,7,11-tetraazacyclotetradecane
$C_{11}H_{16}N_3O$	N-(2-(2-aminoethylamino)ethyl)salicylideneaminate
$C_{11}H_{26}N_4$	1-2(aminoethyl)-1,5,9-triazacyclododecane
$C_{11}H_{26}N_4$	1,4,8,12-tetraazacyclopentadiene
$C_{12}H_9N_2S$	2-mercaptoazobenzoate

$C_{12}H_{10}N_4$	2-pyridinaldazine
$C_{12}H_{11}N_5$	{bis(pyrazol-1-yl)(pyridin-2-yl)}methane
$C_{12}H_{14}NO_2$	4,5-dihydro-4-isopropyl-2(2'-oxidophenyl)oxazole
$C_{12}H_{15}N_7$	N,N,N-tris(1-pyrazolylmethyl)amine
$C_{12}H_{18}N_2S_2$	N,N'-ethylenbis(monothioacetylacetoneiminate)
$C_{12}H_{22}O_2$	bornanediol-derivat bisether
$C_{12}H_{29}N_5$	1,4,7,11,14-pentaazacycloheptadecane
$C_{12}H_{34}N_6$	1,4,8,11-tetraazacyclotetradecane-6,13-diamine
$C_{13}H_{11}N_4S$	3-mercapto-1,5-diphenyl formazan
$C_{13}H_{13}N_2O$	2-[(2-pyrrole)methylimino]-4,6-dimethylphenolate
$C_{13}H_{14}NS_2$	N-butyl-bis-3-mercaptobenzo[b]thiophene-2-aldiminate
$C_{13}H_{18}N$	di(cyclopentadienyl)methyl(dimethyl)ammonium
$C_{13}H_{18}N_2$	α-(tert-butyl-1-aziridinyl-2)benzylideneamine
$C_{13}H_{20}N_2$	α-(tert-butyl-1-aziridinyl-2)benzylamine
$C_{14}H_{19}BrO_4$	2-bromo-1,3-xylyl-15-crown
$C_{14}H_{22}N_2S_2$	N,N'-tetramethylene bis(thioacetylacetoneiminate)
$C_{14}H_{22}N_3S$	1-isopropyl-3-methyl-4-cyclohexylaldimino-5-thiopyrazolate
$C_{14}H_{26}O_5$	cyclohexano-15-crown-5-ether
$C_{14}H_{32}N_4$	1-(3-dimethylaminopropyl)-1,5,9-triazacyclododecane
$C_{15}H_{32}N_4$	1-(2-(pyrrolidin-1-yl)ethyl)-1,5,9-triazacyclododecane
$C_{15}H_{11}O_4$	1,3-bis(2-hydroxyphenyl)-1,3-propanedionate
$C_{15}H_{24}N_3O$	2-(2-hydroxphenyl)-1,5,9-triazacyclododecane
$C_{15}H_{32}N_4$	1-(2-(pyrrolidin-1-yl)ethyl)-1,5,9-triazacyclododecane
$C_{16}H_{13}N_3O_2S$	S-methyl-N',N'-di(salicylidene)isothiosemicarbazide
$C_{16}H_{18}N_4O$	2,2'-bis(1-methylimidazolyl)phenylmethoxymethane
$C_{16}H_{24}O_5$	1,3-xylyl-18-crown-5
$C_{17}H_{31}N_5$	3,6,9,12-tetramethyl-3,6,9,12,18-pentaazabicyclo [12.3.1] octadeca-1(18),14,16-triene
$C_{18}H_9NOS$	2-(2-mercaptophenyl)-iminophenol
$C_{18}H_9N_4O_2P$	bis(4,5-diisopropylimidazo-2-yl)phosphinic acid
$C_{18}H_{13}BrN_4O$	o-bromobenzyl-di(2-pyridyl)ketonohydrazone
$C_{18}H_{14}N_4$	6,6'-bis(4-methylthiazol-2-yl)-2,2'-bipyridine
$C_{18}H_{19}N_5O$	2-bis(2-benzimidazolylmethyl)amino
$C_{18}H_{24}N_2O_2$	1,2-bis(2-oxazolinyl)benzene
$C_{18}H_{37}N_3O_2$	N-tert-butyl-2-(N',N'-diethylamino)-2-(N''-tert-butylimino)-α-alanine ethyl ester
$C_{19}H_{14}N_3S_2$	{2-(2-benzothiazolyl)-6-(2-thiolophenyl)-2-azaethyl}pyridine
$C_{19}H_{17}N_7$	8,15-dihydro-2,6-dimethyl-tripyrido [c,d:i,j:l,m] [1,4,7,8,10,13,15]-heptaazapentadecin
$C_{19}H_{23}N_7$	2,6-bis[1-(2-imidazol-4-yl-ethylimino)-ethyl]pyridine
$C_{20}H_{15}N_2O_3$	4,7-bis(2-hydroxybenzyl)-1-oxa-4,7-diazacyclononane
$C_{20}H_{27}N_3O_2$	3,4:9,10-dibenzo-1,12,15-triaza-5,8-dioxacycloheptadecane
$C_{20}H_{35}N_8O_4$	11-methylamino-6,16-dinitro-4,8,14,18,21-penta-azatetracyclo[14.4.2.$1^{3,9}$.$1^{9,13}$]tetracos-4-enato(6)
$C_{21}H_{17}N_3S_2$	bis(2-thiobenzaldimino)-2,6-diacetylpyridine

$C_{21}H_{34}N_4O$	bis(4,5-diisopropyl-l-methyl-2-imidazolyl)ketone
$C_{23}H_{27}N_7$	2,6-bis[1-((1-carboxymethyl)-2-imidazol-4-ylethyl)imino)ethyl]pyridine
$C_{33}H_{39}N_5$	3,11-dibenzyl-7(2'-pyridylmethyl)-3,7,11,17-tetra-azabicyclo[11.3.1]-heptadeca-1(17),13,15-triene
$C_{58}H_{68}N_8$	1,2,3,7,8,12,13,17,18,19-dodecamethylbiladiene-a,c
$C_{64}H_{60}O_{24}$	1-(o-carboxymethoxyphenoxy)-2-(o-hydroxyphenoxy)ethanolate
daac	diaminodiacetate
damal	diamide malonate
dapo	1,5-diamino-3-azapentane
dapp	2,6-diacetylpyridinebis(2-pyridylhydrazone)
daps	2,6-diacetylpyridine-semicarbazone-2-(semicarbazono)propionyl-hydrazone
dapsc	2,6-diacetylpyridine-bis(semicarbazone)
dapth	2,6-diacetylpyridine-bis(2-thenoylhydrazonate)
dcmomep	deoxycytidine-5'-monophosphate
dhmg	2-(dihydroxymethyl)glycinate
dhp	1,4-dihydro-l-pyridyl
dhtcp	6,7,8,13,14,15,16,17,18,19-decahydro-5H-[e,n][1,4,8,12]-tetraazacyclo-pentadecane
dien	diethylenetriamine
dma	N,N-dimethylacetamide
dmaa	3-(dimethylamino)-2-aminoacrylyl
dmbin	3,3'-dimethyl-2,2'-biindazole
dmf	N,N-dimethylformamide
dmh	2,2-dimethyl-3,5-hexanedionate
dmpd	2,2-dimethylpropane-1,3-diamine
dnbh	6,7-dihydro-15,19-nitrilobenzo[e,p][1,4,7,15]-dithiadiazacyclo-heptadecine
dnbo	7,8-dihydro-6H-16,20-nitrilobenzo[f,g]-[1,5,8,16]-dithiaazacyclo-octadecine
dpt	dipropylenetriamine
dtc	trithioperoxycumato
dtm	dithiopyrilmethane
dtmm	bis(1-phenyl-2,3-dimethyl-5-thiopyril)methane
dtpb	1,1,4,7,7-penta(benzimidazol-2-ylmethyl)-1,4,7-triazaheptane
en	ethylenediamine
er	erythromycin A
Et_2ba	diethylbarbiturate
Et_2nia	N,N-diethylenenicotinamide
Etsacsac	O-ethyl thioacetothioacetate
etsc	S-ethylisothiosemicarbazide
fmpa	(2-formyl-6-methoxyphenoxy)acetate
4-Fpa	4-fluorophenoxyacetate
fum	fumarate
glut	glutamate
ham	n-hexylamine

hfac	hexafluoroacetylacetonate
his	histidinate
hp	hemiporphyrazine
im	imidazole
iprcit	isopropylcitrate
lac	lactate
mal	malonate
mbp	3,3'-iminobis(propylamino) with 2-hydroxy-5-methylbenzophenone
Me	methyl
Meal	methylallyl
MePhsal	N-(4-methylphenyl)salicylaldiminate
Mesal	N-methylsalicylaldiminate
mhapc	8-methyl-3,6,10,13,16,19,1-hexa-azaphosphabicyclo[6,6,6]cosane
mnt	malconitriledithiolate
mp	N-methylpyrrolidinone
mpp	4-methyl-2,6-bis(pyrazol-1-ylmethyl)phenolate
nia	nicotinamide
nim	nitrozyl radical of 3-imidazoline
ntp	2-isopropyl-4,4,5,5-tetramethylimidazoline-1-oxyl-3-oxide
o-(1-ad)	1-adamantanol
ocfb	octaethyl formylbiliverdinate
oep	2,3,7,8,12,13,17,18-octaethylporphinate
ofpa	2-formylphenoxy acetate
omdpp	octamethyldiphenylporphyrin
opd	5-oxoniamesoporphinate-dimethylester
pae	phenoxyacetate
pc	phthalocyanate
Ph	phenyl
phen	1,10-phenanthroline
Phtscac	4-phenylthiosemicarbazone acetate
pia	2-picolylamine
piba	phenoxyisobutyrate
picdien	1,9-bis(2-pyridyl)-2,5,8-triazononane
pip	piperidine
pm	pyridoxamine
pmpn	N-isopropyl-2-methyl-1,2-propanediamine
pn	propanediamine
pnol	1-aminopropane-2-ol
pp	1,2-phenylene-bridged porphyrin
Pr	propyl
pr	propionate
$(PriO)_2PS_2$	di-isopropyldithiophosphate
pro	proline
prop	propionate
psa	N-(2-pyrimidinyl)sulfanilamide

ptpp	5-pyridyl-10,15,20-triphenylporphyrinate
pur	purpurate
py	pyridine
pyac	pyridyl-2-acetate
pyd	pyrozine-2,3-dicarboxylate
pyr	pyrazine
pyt	pyridine-2-thiolate
py_3tach	1,3,5-tris(pyridine-2-carboxaldimino)cyclohexane
qu	quinoline
Sach	sacharinate
Sal	salicylaldiminate
sc	semicarbazide
sd	2-sulfanilamidopyrimidinate
ser	serinate
spa	sulphinamide
taa	1,3,5,7-tetraazaadamantane
tacd	1,4,7,10-tetraazacyclododecane
tbhpp	$\alpha,\beta,\gamma,\delta$-tetrakis(3,5-di-tert-butyl-4-hydroxyphenyl)porphyrin
tc	4-thiazolidine-carboxylate
tcpp	$\alpha,\beta,\gamma,\delta$-tetrakis(o-cyanophenyl)porphyrinate
tdcpp	tetrakis(2,6-dichlorophenyl)porphinate
tg	tetragonal
thf	tetrahydrofuran
thgly	thiodiglycolate
tmt	1,4,8,11-tetramethyl-1,4,8,11-tetra-azacyclotetradecane
tol	toluidine
tpc	2,3-dihydro-$\alpha,\beta,\gamma,\delta$-tetraphenylporphyrinate
tpibc	2,3,7,8-tetrahydro-5,10,15,20-tetraphenylporphinate
tpp	tetraphenylporphyrinate
tptbp	tetraphenyltetrabenzoporphyrinate
tpyp	$\alpha,\beta,\gamma,\delta$-tetra(4-pyridyl)porphinate
tr	triclinic
tre	threoninate
tren	tris(2-aminoethyl)amine
trien	triethylenetetramine
trppe	{5-((2-(3-pyridyl)ethyl)carbonylamino)phenyl)-10,15,20-triphenyl-porphinate
tsap	1-(3-(p-toluenesulfonamido)propyl)-1,5,9-triazacycloundecane
tsc	thiosemicarbazide
ts-β-ala	N-tosyl-β-alaninate
tta	1-(2-thienl)-4,4,4-trifluoro-1,3-butanedionate
ttfa	thenoyltrifluoroacetone
tu	thiourea
xan	xanthiosinate

2. INTRODUCTION

Zinc has a relatively low abundance in nature (10^{-6} of the earth's crust) but the chemistry of zinc compounds has been extensively investigated, and the relationships between structure and biomedical activity are of major importance. Zinc appears to be one of the more biologically important metals,[1] second only to iron among the heavy metals (i.e. excluding sodium, potassium, magnesium and calcium).

Many structural studies of zinc(II) compounds have been carried out and sporadically summarised in annual reports.[2] To date there has not been a comprehensive overview of these structures, and this present review is aimed at providing such to cover the period up to the end of 1992. Almost six hundred published zinc(II) structures are included in this analysis and classification. It is hoped that such a survey will assist in understanding stereochemical interactions in the coordination sphere of zinc(II) species.

The derivatives have been sorted by nuclearity and subdivided according to the coordination number of the metal atom. Within each coordination number, the compounds are listed in order of increasing covalent radius of the principle coordinating ligand atom and increasing complexity of the coordination sphere.

3. MONOMERIC ZINC(II) COMPOUNDS

3.1 *Coordination Numbers Two and Four*

Crystallographic and structural data for zinc(II) compounds with coordination numbers two and four are presented in Table 1. There are only four examples of the former,[3,4] in which the two coordination sites are occupied by unidentate C-donor ligands to give a linear geometry. The Zn-C bond distances range from 1.950(2) to 1.980(4)Å with a mean value of 1.966Å, and the C-Zn-C angles are 180.0°[3,4] and 175.9(1)°. All three complexes are organometallic.

Coordination number four is by far the most common in the chemistry of zinc(II). The two limiting configurations generally observed are tetrahedral and square planar. The data for over two hundred and sixty such complexes of zinc(II) are given in Table 1, of which only a few can be classified as (distorted) square planar.[28–33] In these the coordination sphere is created by the four nitrogen atoms of a macrocyclic ligand, with the mean Zn-N bond distance of 2.031(51,29)Å. Most of these species are either red or purple in colour.

All of the other examples in Table 1 are essentially tetrahedral. There are examples with uni-, bi-, tri- and tetradentate ligands creating various degrees of distortion about the zinc(II) atom. With the chelating ligands different sizes of metallocyclic rings are found, with corresponding variations in bond angles. Both electronic and steric effects are reflected in the L-Zn-L ring angles. For four-membered rings the S-Zn-S angle varies from 84.0° to 85.5° when the ligand is saturated, and from 73.8° to 76.4° when the ligand is unsaturated. For the five-membered rings the mean L-Zn-L angles are: 72.3(7,7)° for O-donors; 77.3(2.3,1.4)° for unsaturated N-donors; 84.3(2.8,3.7)° for saturated N-donors; and 94.6(3.3,2.1)° for S-donors. This reflects the different covalent radii of the respective donor atoms. For the six-membered rings the mean L-Zn-L intraligand

Table 1 Crystallographic and structural data for zinc(II) compounds: coordination numbers two and four[a].

COMPOUND (colour)	Crys.cl. Sp. Grp Z	a[Å] b[Å] c[Å]	α[°] β[°] γ[°]	Chromo-phore		Zn-L [Å]		L-Zn-L [°]	Ref.
$Zn\{(2,4\text{-}Bu^t)_2C_5H_5\}_2$	*m*	9.748(2)		ZnC_2	C[b]	1.969(8,0)	C,C[b]	180,0(0)	3
(colourless)	$P2_1/n$	11.444(3)	110.46(2)						
	2	12.511(3)							
$Zn\{(MeOMe_2Si)\cdot(Me_3Si)_2C\}_2$	*m*	9.283(6)		ZnC_2	C	1.980(4,0)	C,C	180	4[a]
(not given)	$P2_1/n$	17.393(7)	104.88(4)						
	2	10.407(3)							
$Zn\{(HOMe_2Si)\cdot(Me_3Si)_2C\}_2$	*tr*	9.324(2)	80.39(2)	ZnC_2	C	1.965(2)	C,C	175.9(1)	4[a]
(not given)	$P\bar{1}$	11.275(3)	85.25(1)			1.970(2)			
	2	15.708(2)	70.95(2)						
$[Zn(Et)_2]$	*tr*	8.503(6)	111.8(1)	ZnC_2	C	1.950(2)	C,C	180	4[b]
(18-crown-6)	$P\bar{1}$	8.719(8)	114.8(1)						
(colourless)	1	8.296(7)	97.9(1)						
$[Zn(C_7H_9NO)_4]\cdot(NO_3)_2$	*or*	27.471(20)		ZnO_4	O	1.90(1,0)	O,O	109.5(5,2.8)	5
(not given)	Pbcn	9.509(5)				1.96(1,0)			
	4	12.666(4)							
$Zn(C_5H_6NO_3)_2(H_2O)_2$	*m*	14.834(8)		ZnO_4	O	1.925(1,0)	O,O	98.44(6)	6
(not given)	*C*2	5.888(3)	98.34(5)		H_2O	1.984(1,0)		105.5(1,2.8)	
	2	7.920(6)						131.83(7)	
$Zn(4\text{-}ClC_6H_4CO_2)_2(H_2O)_2$	*m*	26.119(9)		ZnO_4	O	1.991(5,0)	O,O	136.9(2)	7
(white)	*C*2/*c*	4.989(2)	106.29(4)		H_2O	1.973(5,0)		not given	
	4	11.910(7)							
$Zn(2\text{-}OHC_6H_4CO_2)_2(H_2O)$	*m*	15.43(2)		ZnO_4	O	2.03	O,O	not given	8
(not given)	*C*2	5.35(2)	93.8		H_2O	2.06			
	2	9.18(2)							
$Zn(C_7H_8O_2)_2(NO_3)_2$	*m*	16.786(8)		ZnO_4	O	1.979(2,0)	O,O	87.0(1)	9
(not given)	*A*2/*a*	12.922(8)	106.80(4)		O_2NO	2.037(2,0)		110.6(1,1.2)	
	4	9.089(4)						118.8(1)	
$[Zn(NH_4\cdot C_{64}H_{60}O_{24})]$	or	14.046(7)		ZnO_4	O	1.948(3,0)	O,O	109.5(1,8.7)	10
2 EtOH	Pncb	14.577(5)							
(colourless)	2	16.691(11)							
$[Zn(NH_3)_4]\cdot B_8H_8$	*tg*	7.503(5)		ZnN_4	H_3N	2.05 (1,0)	N,N	109.5(6,1.0)	11
(not given)	$P4_2/nmc$	—							
	2	10.784(8)							
$[Zn(imH)_4](ClO_4)_2$	m	18.113(9)		ZnN_4	N	1.997(7,0)	N,N	109.5(3,3.8)	12
(colourless)	*C*2/*c*	7.107(2)	117.58(9)			2.001(7,0)			
	4	20.163(9)							

Table 1 *Continued*

COMPOUND (colour)	Crys.cl. Sp. Grp Z	a[Å] b[Å] c[Å]	α[°] β[°] γ[°]	Chromo-phore		Zn-L [Å]		L-Zn-L [°]	Ref.
$[Zn(cmh)_4]SO_4 \cdot 10H_2O$	m	15.143(2)		ZnN_4	N	2.01(1,0)	N,N	109.5(-,3.5)	13
(not given)	$P2_1$	20.586(4)	97.89(1)						
	2	11.007(2)							
$[Zn(C_5H_6N_2S)_4] \cdot (ClO_4)_2 \cdot 2Me_2CO$	or	46.744(1)		ZnN_4	N	2.059(4,1)	N,N	109.5(2,3.8)	14
	$Fdd2$	20.34(1)							
(yellow)	8	8.015(1)							
$Zn(sc)_2(NH_3)_2$	or	13.894(1)		ZnN_4	N	2.122(4,44)	N,N	99.5(2,9.7)	15
(not given)	$Pn2_1a$	14.221(1)			H_3N	2.043(4,7)		131.0(2,5.5)	
	4	12.608(1)							
$Zn(psa)_2(NH_3)_2$	or	13.887(4)		ZnN_4	N	2.094(8,7)	N,N	110.0	16[a]
(white)	$Pn2_1a$	14.217(4)			H_3N	2.047(9,25)			
	4	12.603(4)							
$Zn(N_3)(py)_2$	m	8.528(1)		ZnN_4	N	1.937(17,9)	N,N	109.5(7,9,5)	16[b]
(colourless)	$P2_1/c$	20.161(2)	106.13(1)		pyN	2.032(15,24)			
	4	8.064(1)							
Zn(thiamine)$(NCS)_3$	m	17.764(5)		ZnN_4	N	2.027(4)	N,N	not given	17
(colourless)	$P2_1/a$	12.484(2)	125.46(2)		SCN	1.951(4,10)		(109.5)	
	4	12.104(2)							
$Zn(p\text{-}tol)_2(NCS)_2$	m	12.033(6)		ZnN_4	N	2.056(4,12)	N,N	109.5(2,6.4)	18
(not given)	$P2_1/c$	13.873(6)	114.7(2)		SCN	1.933(5,15)			
	4	12.444(6)							
$Zn(C_6H_{11}N_3)_2(NCS)_2$	m	16.829(2)		ZnN_4	N	2.000(2,0)	N,N	109.5(2,2.3)	19
(not given)	$C2/c$	6.391(3)	103.873(3)		SCN	1.941(3,0)			
	4	19.878(3)							
$Zn(dhp)_2(py)_2$	or	6.548(4)		ZnN_4	N	1.969(8,0)	N,N	109.5(3,14.4)	20
(not given)	$P22_12_1$	11.877(6)			pyN	2.129(7,0)			
	2	12.004(5)							
$Zn(5,5'\text{-}Et_2ba)_2(3\text{-}Mepy)_2$	tr	13.013(5)	114.4(2)	ZnN_4	N	1.997(3,10)	N,N	109.5(1,15.1)	21
(colourless)	$P\bar{1}$	11.748(5)	90.9(2)		pyN	2.082(3,13)			
	2	10.842(5)	90.3(2)						
$Zn(C_{12}H_{15}N_7)(NCS)_2$	m	10.202(3)		ZnN_4	N	2.014(7,10)	N,	109.5(3,11.7)	22[a]
(colourless)	$P2_1/c$	14.730(3)	112.11(2)		SCN	1.951(9,24)			
	4	13.415(2)							

Table 1 *Continued*

COMPOUND (colour)	Crys.cl. Sp. Grp Z	a[Å] b[Å] c[Å]	α[°] β[°] γ[°]	Chromo-phore		Zn-L [Å]		L-Zn-L [°]	Ref.
$[Zn\{(MeHNCH_2)_3CMe\}\cdot(NCS)_2]$ (colourless)	*or* Pbca 8	8.215(2) 15.520(4) 28.017(8)		ZnN_4	N SCN	2.04(1,3) 1.99(1,5)	N,N	101(4)[d] 107.8(5,4.9) 123.7(5)	22[b]
$[Zn(L\text{-}his)_2]\cdot 2H_2O$ (not given)	*tg* $P4_12_12$ 4	7.53(2) — 30.411(5)		ZnN_4	N	2.05(–,1)	N,N	110(–,14)	23
$[Zn(L\text{-}his)_2]\cdot 2H_2O$ (not given)	*tg* $P4_32_12$ 4	7.53(2) — 30.41(5)		ZnN_4	N	2.030(20,4)	N,N	109.5(1.0,13.0)	24[a]
$[Zn(DL\text{-}his)_2]\cdot 5H_2O$ (not given)	*m* *C2/c* 4	16.41(15) 14.755(15) 10.99(15)	129.6(15)	ZnN_4	N	2.000 2.049	N,N	109.5(–,12.5)	24[b]
$Zn(C_9H_{13}N_2)_2$ (not given)	*or* Pbcn 4	17.166(5) 7.209(5) 15.232(3)		ZnN_4	N	1.975(2,0) 2.067(2,0)	N,N	84.1(1)[c] 123.5(1,3.8)	25
$[Zn(dmpd)_2]I_2$ (white)	*tg* $P4_2/nmc$ 2	8.417(2) — 12.726(2)		ZnN_4	N	2.041(7,0)	N,N	97.6(4)[d] 115.7(2)	26
$[Zn(tdcpp)\cdot PhMe$ (green yellow)	*tr* $P\bar{1}$ 2	10.532(5) 15.394(6) 16.224(4)	70.01(3) 76.47(3) 84.28(3)	ZnN_4	N	1.975(5,17)	N,N	94.8(2,3)[d] 117.2(2,6.7)	27
Zn(hexyl-tpp) (red-purple)	*m* $P2_1/n$ 2	8.608(2) 22.212(4) 13.774(2)	91.90(1)	ZnN_4	N	2.030(3,3)	N,N	90.0(1,1)[d]	28
Zn(tpp) (not given)	*tr* $P\bar{1}$ 1	10.382(1) 12.421(2) 66.443(1)	98.30(1) 101.15(1) 96.47(1)	ZnN_4	N	2.037(2,8)	N,N	90.0(1,2)[d]	29
[Zn(tpp)]·2 toluene (not given)	*tr* $P\bar{1}$ 1	11.349(2) 11.404(2) 10.502(2)	110.48(2) 103.87(2) 107.65(2)	ZnN_4	N	2.036(2,4)	N,N	90.0(1,3)[d]	30
$[Zn(tbhpp)]\cdot 2\ C_6H_{12}$ (dark purple)	*m* *C2/c* 4	27.966(7) 26.847(4) 21.275(2)	131.09(3)	ZnN_4	N	2.041(8,0)	N,N	90.0(3)[d]	31
$[Zn(omdpp)]\cdot 3\ CH_2Cl_2$ (not given)				ZnN_4	N	2.06		not given	32

Table 1 *Continued*

COMPOUND (colour)	Crys.cl. Sp. Grp Z	a[Å] b[Å] c[Å]	α[°] β[°] γ[°]	Chromo-phore		Zn-L [Å]		L-Zn-L [°]	Ref.
Zn(pc)	*m*	19.274(5)		ZnN_4	N	1.980(2,1)	N,N	90.0(1,1.0)[d]	33
(not given)	$P2_1/a$	4.8538(15)	120.48(2)						
	2	14.553(4)							
$[Zn(C_{14}H_{32}N_4)]\cdot(ClO_4)_2$	*or*	15.054(8)		ZnN_4	N	2.00	N,N	109.5(–,4.7)	34
(not given)	Pcab	15.34(1)							
	8	19.25(1)							
$[Zn(C_{15}H_{32}N_4)]\cdot(ClO_4)_2$	*or*	13.875(13)		ZnN_4	N	2.04	N,N	87.8[c]	34
(not given)	$Pn2_1a$	9.811(6)						105.8	
	4	16.186(9)						123.1	
[Zn(tsap)]PF6	*or*	17.508(4)		ZnN_4	N	1.925(3)	N,N	103.1(1.3.6)	35[a]
(not given)	Pbac	15.394(4)				2.025(3,12)		121.4(2,1.9)	
	8	18.377(5)							
Zn(2-Meallyl)$_2$	*tc*	8.3452(4)		ZnC_4	C	2.043(1)	C,C	not given	35[b]
(colourless)	$P3_221$	—				2.441(1)			
	3	10.565(1)							
$(MeNH_3)_2[ZnCl_4]$	*m*	10.873(3)		$ZnCl_4$	Cl	2.267(2,6)	Cl,Cl	109.5(1,3.6)	36
(not given)	$P2_1/a$	12.655(2)	96.71(2)						
	4	7.648(1)							
$(Me_3NH)_2[ZnCl_4]$	*or*	10.660(1)		$ZnCl_4$	Cl	2.262(2,21)	Cl,Cl	109.5(1,5.2)	37
(not given)	Pnma	9.629(1)							
	4	14.991(2)							
$(Me_4N)_2[ZnCl_4]$	*or*	12.276(2)		$ZnCl_4$	Cl	2.249(4,5)	Cl,Cl	109.5(2,2.6)	38[a]
(not given)	Pnma	8.998(2)							
	4	15.541(2)							
$(Me_4N)_2[ZnCl_4]$	*m*	8.953(2)		$ZnCl_4$	Cl	2.260(4,24)	Cl,Cl	109.5(1,2.2)	38[b]
(not given)	$P2_1/n$	15.456(10)							
(at 250K)	12	36.595(8)	90.19(4)						
$(C_{13}H_{27}NH_3)_2[ZnCl_4]$[e]	*m*	10.644(2)		$ZnCl_4$	Cl	2.311(4,63)	Cl,Cl	109.5(2,3.4)	39
(not given)	$P2_1$	7.3074(9)	94.24(2)						
	4	44.043(7)		$ZnCl_4$	Cl	2.261(4,31)	Cl,Cl	109.5(2,1.6)	
$(C_{14}H_{29}NH_3)_2[ZnCl_4]$	*m*	7.3980(7)		$ZnCl_4$	Cl	2.261(1,20)	Cl,Cl	109.5(1,3.9)	40
(not given)	$P2_1/c$	10.254(1)	92.794(7)						
	4	47.639(5)							

Table 1 *Continued*

COMPOUND (colour)	Crys.cl. Sp. Grp Z	a[Å] b[Å] c[Å]	α[°] β[°] γ[°]	Chromo-phore		Zn-L [Å]		L-Zn-L [°]	Ref.
$(C_{14}H_{23}N_2O)_2[ZnCl_4]$	*m*	9.137(1)		$ZnCl_4$	Cl	2.259(3,30)	Cl,Cl	109.5(1,3.8)	41
(colourless)	$P2_1/c$	19.213(2)	95.82(1)						
	4	19.707(2)							
$(C_6H_{14}N_2)[ZnCl_4]$	*m*	9.572(1)		$ZnCl_4$	Cl	2.264(1,11)	Cl,Cl	109.5(1,4.1)	42
(not given)	$P2_1/c$	6.767(2)	92.74(1)						
	4	18.310(4)							
$(C_6H_4N_4)[ZnCl_4]$	*tg*	10.511(4)		$ZnCl_4$	Cl	2.283(2,0)	Cl,Cl	109.5(2,7.5)	43
(pale yellow)	$P42_1m$	—							
	2	5.249(9)							
$(Me_4As)_2[ZnCl_4]$	*tg*	17.824(2)		$ZnCl_4$	Cl	2.254(5,13)	Cl,Cl	109.5(2,4.6)	44
(not given)	$P4_2/mbc$	—							
	16	25.209(3)							
$(C_6H_{12}S_2)[ZnCl_4]$	*or*	13.18(1)		$ZnCl_4$	Cl	2.270(3,13)	Cl,Cl	109.4(1,2.7)	45
(colourless)	Pnma	8.38(1)							
	4	11.55(1)							
$(xantine)_2[ZnCl_4]$	*or*	19.701(6)		$ZnCl_4$	Cl,	2.272(2,26)	Cl,Cl	109.5(1,4.4)	46
(colourless)	$Pmn2_1$	6.583(1)							
	2	6.610(2)							
$(C_7H_7N_2)_2[ZnCl_4]$	*tr*	8.956(4)	99.77(2)	$ZnCl_4$	Cl	2.271(1,22)	Cl,Cl	109.5(1,3.5)	47
(not given)	$P\bar{1}$	15.381(7)	105.70(4)						
	2	7.195(3)	103.72(3)						
$[ZnCl_4]$ $[Zn(8\text{-}H_2Nqu)_2 \cdot H_2O]$	*m*	11.234(1)		$ZnCl_4$	Cl	2.273(5,2)	Cl,Cl	109.5(1,3.2)	48
	C2/c	10.8527(8)	108.43(1)						
(not given)	4	19.025(2)		ZnN_4O		see Table 2			
$[ZnCl_4]$ [Co(tren)·(dmaa)]·Cl.H_2O	*m*	14.608(3)		$ZnCl_4$	Cl	2.273(1,44)	Cl,Cl	109.4(1,8.4)	49
	$P2_1/n$	15.517(4)	100.75(2)						
(orange)	4	10.562(2)							
$[ZnCl_4]$ [Co(mhapc)]·Cl	*m*	9.644(2)		$ZnCl_4$	Cl	not given			50
(orange)	$P2_1/n$	24.394(4)	91.89(1)						
	4	10.419(2)							
π-$[ZnCl_4]$ [Co(dien)·(en)Cl]	*m*	13.745(3)		$ZnCl_4$	Cl	2.261(3,19)	Cl,Cl	109.5(1,5.0)	51
(purple-red)	$P2_1/n$	8.202(2)	98.56(1)						
	4	15.117(6)							

Table 1 *Continued*

COMPOUND (colour)	Crys.cl. Sp. Grp *Z*	*a*[Å] *b*[Å] c[Å]	α[°] β[°] γ[°]	Chromo-phore		Zn-L [Å]		L-Zn-L [°]	Ref.
χ-[$ZnCl_4$][Co(dien)·(en)Cl]	*m*	9.676(1)		$ZnCl_4$	Cl	2.273(5,17)	Cl,Cl	109.5(2,2.2)	51
(not given)	*Cc*	12.790(2)	93.63(1)						
	4	13.888(3)							
β-[$ZnCl_4$][Co(dien)·(1,2-pn)Cl]	*m*	9.744(2)		$ZnCl_4$	Cl	2.276(2,13)	Cl,Cl	109.5(1,3.4)	52
(deep red)	*Cc*	13.263(3)	95.26(1)						
	4	13.955(2)							
[$ZnCl_4$][Co(tren)·(py)Cl]·	*or*	18.177(8)		$ZnCl_4$	Cl	2.261(3,34)	Cl,Cl	109.5(1,4.5)	53
$0.5H_2O$	$P2_12_12_1$	12.564(6)							
(not given)	4	8.932(4)							
[$ZnCl_4$] [Co(picdien)Cl]	*or*	16.363(7)		$ZnCl_4$	Cl	2.263(8,53)	Cl,Cl	109.5(3,5.1)	54
(not given)	Pbca	18.382(8)							
	8	14.940(6)							
[$ZnCl_4$] [Co(en)$_2$·(pnol)Cl]	*or*	12.330(1)		$ZnCl_4$	Cl	2.272(19,54)	Cl,Cl	109.5(6,7.1)	55
(red)	$P2_12_12_1$	13.905(2)							
	4	10.916(1)							
β-[$ZnCl_4$] [Co(dpt)·(en)cl]	*m*	7.875(3)		$ZnCl_4$	Cl	2.264(9,22)	Cl,Cl	109.5(3,8.5)	56
(violet)	$P2_1c$	15.824(11)	94.69(5)						
	4	14.748(8)							
[$ZnCl_4$][Co(trien)·(pro}]	*m*	7.01(1)		$ZnCl_4$	Cl	2.264(4,29)	Cl,Cl	109.5(2,9.0)	57
(orange)	$P2_1$	15.58(2)	109.9(3)						
	2	9.66(1)							
[$ZnCl_4$] [Co(tren)·(dhmg)]	*m*	9.217(2)		$ZnCl_4$	Cl	not given		not given	58
(orange)	*Cc*	16.926(3)	99.2(2)						
	4	13.315(2)							
[$ZnCl_4$] [Co(Metren)·	*m*	12.850(1)		$ZnCl_4$	Cl	2.269(2,27)	Cl,Cl	109.5(7,3.3)	59
(NH_3)Cl]	$P2_1/c$	11.754(1)	96.41(1)						
(red)	4	11.863(1)							
[$ZnCl_4$] [Co(Metren)·	*or*	11.681(1)		$ZnCl_4$	Cl	2.275(2,54)	Cl,Cl	109.5(8,6.0)	59
(NH_3)Cl]	$P2_12_12_1$	16.717(1)							
(red)	4	9.195(1)							
[$ZnCl_4$] [Co(Metren)·	*m*	13.770(1)		$ZnCl_4$	Cl	2.268(7,12)	Cl,Cl	109.5(1,4.7)	59
(NH_3)Cl]·H_2O	$P2_1/n$	12.205(1)	92.72(2)						
(red)	4	10.613(1)							

Table 1 *Continued*

COMPOUND (colour)	Crys.cl. Sp. Grp Z	a[Å] b[Å] c[Å]	α[°] β[°] γ[°]	Chromo-phore		Zn-L [Å]		L-Zn-L [°]	Ref.
$[ZnCl_4]$ [Co(apt)·(tacd)]· H_2O (green)	look original			$ZnCl_4$	Cl	2.251(2,51)	Cl,Cl	109.5(1,3.3)	60
$[ZnCl_4]$ [Co(amidine)· (en)Cl] (red-brown)	*m* *Cc* 4	10.405(3) 11.858(3) 14.104(6)	?	$ZnCl_4$	Cl	2.270(5,47)	Cl,Cl	109.5(2,1.7)	61
$[ZnCl_4]$ [Co(aza·capten)] (red)	*c* $P2_13$ 4	13.370(1)		$ZnCl_4$	Cl	2.273(2,4)		not given	62
$[ZnCl_4]$ [Co(aeaa)· (en)Cl] (not given)	*m* $P2_1/c$ 4	8.340(1) 11.493(1) 20.789(1)	102.9(1)	$ZnCl_4$	Cl	not given		not given	63
$[ZnCl_4]$ [Co(aeaa)·(en)]· H_2O (not given)	*m* $P2_1/c$ 4	12.654(6) 11.073(6) 14.06(7)	99.72(5)	$ZnCl_4$	Cl	not given		not given	63
$[ZnCl_4][Co(spa)\cdot(en)\})]$ (pink orange)	*or* $P2_12_12_1$ 4	16.073(1) 17.139(1) 6.3427(8)		$ZnCl_4$	Cl	not given		not given	64
$[ZnCl_4]$ $[Co(C_{20}H_{35}\cdot N_8O_4]\cdot$ H_2O (dark green)	*or* *P*bca 8	11.633(4) 16.340(4) 29.507(7)		$ZnCl_4$	Cl	not given		not given	65
$[ZnCl_4]$ [Co(Metmd)· (dien) Cl)] (not given)	*or* $P2_12_12_1$ 4	14.356(1) 15.468(2) 8.342(1)		$ZnCl_4$	Cl	2.269(4,18)	Cl,Cl	109.5(4,4.9)	66
$[ZnCl_4]$ [Co(dien)·(depo)] (not given)	*m* $P2_1/c$ 4	13.890(2) 7.665(1) 16.761(2)	94.13(1)	$ZnCl_4$	Cl	2.272(1,42)	Cl,Cl	109,5(1,7.3)	67
$[ZnCl_4]$ $[Ni(MeCN)_6]^e$ (blue)	*tr* $P\bar{1}$ 4	16.25(5) 18.40(5) 8.51(5)	94.4(5) 83.9(5) 114.5(5)	$ZnCl_4$ $ZnCl_4$	Cl Cl	2.270(17,19) 2.265(15,11)	Cl,Cl Cl,Cl	109.5(4,1.9) 109.5(4,3.5)	68[a]
$[ZnCl_4]$ [Ni(cyclam)] (not given) (at 173K)	*or* $P4_12_12$ 4	9.879(1) — 18.289(3)		$ZnCl_4$	Cl	2.266(2,12)	Cl,Cl	109.5(1,4.2)	68[b]
$[ZnCl_4]$ $[Fe(C_{13}H_{18}N)]_2\cdot$ H_2O (orange brown)	*m* $P2_1/c$ 4	18.076(6) 14.038(5) 12.246(5)	95.70(1)	$ZnCl_4$	Cl	2.268(8,39)	Cl,Cl	109.5(3,4.3)	69

Table 1 *Continued*

COMPOUND (colour)	Crys.cl. Sp. Grp Z	a[Å] b[Å] c[Å]	α[°] β[°] γ[°]	Chromo-phore	Zn-L [Å]		L-Zn-L [°]		Ref.
$[ZnCl_4]$ $[W_3O(ac)_6.(H_2O)_3]\cdot 4H_2O$ (deep blue)	*m* $P2_1/n$ 4	14.324(2) 17.081(2) 13.715(2)	90.87(3)	$ZnCl_4$	Cl 2.26(1)		Cl,Cl not given		70
$[ZnCl_4]$ $[W_3O(ac)_5\cdot (MeO)(H_2O)_3]\cdot 7H_2O$ (blue)	*tr* $P\bar{1}$ 2	14.063(7) 14.216(7) 9.613(5)	103.78(5) 100.91(5) 107.38(5)	$ZnCl_4$	Cl 2.259(8)		Cl,Cl not given		70
$[ZnCl_4]$ $[Cr(en)_3]\cdot Cl$[e] (orange)	m $P2_1/c$ 8	21.215(3) 12.532(2) 13.707(2)	95.21(1)	$ZnCl_4$ $ZnCl_4$	Cl 2.265(1,27) Cl 2.268(1,83)		Cl,Cl 109.5(–,5.3) Cl,Cl 109.5(–,6.0)		71
$[ZnCl_4]$ $[Cr(cyclam)]\cdot[Cl_2]_2$ (brown purple)	*tg* $P4_2/n$ 2	16.377(4) – 6.821(2)		$ZnCl_4$	Cl 2.268(1,0)		Cl,Cl 109.5(1,5.6)		72
$[ZnCl_4]_2\cdot[Cr_2(Me_3N\cdot CH_2CO_2)_4(H_2O)_2]\cdot 2H_2O$ (not given)	*m* $P2_1/c$ 2	11.6420(6) 9.3595(5) 21.0985(11)	104.252(5)	$ZnCl_4$	Cl 2.268(2,27)		Cl,Cl 109.51(1,3.6)		73
$[ZnCl_4]$ $[Ru(en)_3]$ (yellow)	*or* $Pna2_1$ 4	15.976(5) 7.683(4) 14.160(3)		$ZnCl_4$	Cl 2.269(3,10)		Cl,Cl 109.5(1,4.8)		74
$[ZnCl_4]_2[Ru_2(NH_3)_{10}\cdot(pyz)]$ (dark purple)	*or* Pcab 4	11.348(2) 11.614(2) 22.144(3)		$ZnCl_4$	Cl not given		not given		75
$[ZnCl_4]$ $[Re_2(O)Cl_4\cdot (C_9H_{21}N_3)]$ (brown)	*or* Pbnb 4	8.614(4) 14.589(3) 25.24(1)		$ZnCl_4$	Cl not given		not given		76
$[Zn(tu)_4]\cdot(NO_3)_2$ (colourless)	*or* Pnaa 4	22.434(23) 9.465(2) 8.859(1)		ZnS_4	S 2.343(3,19)		S,S 109.5(1,12.0)		77
$(PPh_4)_2[Zn(PhS)_4]$ (not given)	*or* $Pbc2_1$ 4	13.735(2) 17.499(6) 24.810(5)		ZnS_4	S 2.353(3,24)		S,S 109.5(2,12.8)		78
$[Zn(C_4H_6N_2S)_4]\cdot(NO_3)_2\cdot H_2O$ (not given)	*or* Pbca 8	20.756(8) 12.410(5) 22.059(8)		ZnS_4	S 2.339(2,12)		S,S 109.5(1,12.0)		79
(Et_4N) $[Zn(Ph_2PS_2)_3]$ (not given)	*m* $P2_1/c$ 4	11.160(6) 9.962(5) 43.11(3)	104.73(5)	ZnS_4	S 2.306(2,1) S 2.451(2,2)		S,S 84.01(7)[f] 108.4(1,1.4) 120.3(1,2.9)		80

Table 1 *Continued*

COMPOUND (colour)	Crys.cl. Sp. Grp *Z*	*a*[Å] *b*[Å] c[Å]	α[°] β[°] γ[°]	Chromo-phore		Zn-L [Å]		L-Zn-L [°]	Ref.
(Me_4N) [Zn {(p-$MeC_6H_4O)PS_2$}] (not given)	*m* $P2_1a$ 4	29.311(9) 11.032(3) 17.515(5)	106.83(2)	ZnS_4	S S	2.302(4,6) 2.423(4,0)	S,S	85.5(1)[f] 105.1(1,1) 118.9(1,7)	80
(Et_4N) $[Zn(Me_2NCS_2)_3]$ (colourless)	*or* Pbca 8	14.709(14) 18.780(13) 20.130(19)		ZnS_4	S S	2.306(2,7) 2.440(2,18)	S,S	73.71(7)[f] 111.6(1,2.0) 125.18(9)	81
$Zn(Me_2NCS_2)_2$ (colourless)	*m* *C*2/*c* 8	8.455(3) 15.747(5) 18.345(9)	104.76(4)	ZnS_4	S S	2.323(6,11) 2.401(6,28)	S,S	76.4(2)[f] 109.7(2,4.0) 136.5(2)	82
$Zn(Et_2NCS_2)_2$ (colourless)	*m* $P2_1/c$ 4	10.015(10) 10.661(5) 16.357(10)	111.58(5)	ZnS_4	S S	2.343(3,12) 2.413(3,30)	S,S	75.5(1)[f] 107.9(1,4.4) 134.4(1)	83
$Zn(Et_2NCS_2)_2$ (colourless)	*m* $P2_1/c$ 4	10.02 10.67 16.35	112.0	ZnS_4	S S	2.34(–,2) 2.42(–,2)	S,S	105 137	84[a]
$Zn(EtOCS_2)_2$ (not given)	*m* $P2_1/c$ 4	18.278(14) 5.700(3) 11.381(12)	101.47(10)	ZnS_4	S	2.358(10,21)	S,S	109.5(3,5.7)	84[b]
$(Ph_4As)_2$ $[Zn(C_2O_2S_2)_2]$ (light yellow)	*tr* $P\bar{1}$ 2	10.427(1) 12.654(1) 18.639(2)	94.55(1) 97.27(1) 81.48(1)	ZnS_4	S	2.317(2,17)	S,S	95.4(1,2)[c] 116.9(1,4.2)	85
$(Ph_4P)_2[Zn(S_6)_2]$ (lemon yellow)	*or* Pbcn 4	13.693(14) 18.884(19) 19.779(16)		ZnS_4	S	2.333(5,8)	S,S	117.5(2)[g] 105.7(2,1.7)	86
$Zn(C_6H_5CS_2)_2$ (red-orange)	*tr* $P\bar{1}$ 2	8.804(10) 8.123(10) 11.208(10)	87.35(10) 111.20(10) 90.32(10)	ZnS_4	S	2.347(4,40)	S,S	76.6(1,5)[f] 128.0(1,5.5)	87[a]
$Zn\{(Pr^iO_2PS_2\}_2$ (colourless)	*m* *C*2/*c* 8	10.934(8) 17.098(6) 25.587(12)	99.23(4)	ZnS_4	S	2.304(6,2) 2.380(5,29)	S,S	85.5(2)[c] 113.0(2,8.3)	87b
$Zn(C_7H_5S_3)_2$ (black)	*m* *C*2/*c* 4	20.654(10) 4.078(10) 21.303(10)	112.30(5)	ZnS_4	S	2.332(3,4)	S,S	95.8(1)[c] 100.6(1) 136.4(1)	88
$Zn(O\text{-}Etsacsac)_2$ (pale yellow)	*m* *C*2/*c* 4	22.769(3) 5.261(3) 14.907(3)	106.33(1)	ZnS_4	S	2.302(1,32)	S,S	104.28(3)[d] 113.0(1,6.3)	89

Table 1 *Continued*

COMPOUND (colour)	Crys.cl. Sp. Grp Z	a[Å] b[Å] c[Å]	α[°] β[°] γ[°]	Chromo-phore	Zn-L [Å]		L-Zn-L [°]		Ref.
$(Ph_4As)_2$ $[Zn(mnt)_2]$	*m*	17.559(3)		ZnS_4	S	2.333(2,13)	S,S	93.7(2,5)[c]	90
(yellow)	$P2_1/c$	16.828(3)	110.43(1)						
	4	18.542(2)							
$Zn(p\text{-}dtc)_2$	*m*	25.262(6)		ZnS_4	S	2.320(3,7)	S,S	96.7(1)[c]	91
(orange red)	*C2/c*	8.065(2)	147.49(2)					117.9(1)	
	4	21.047(5)							
(Me_4N_2) $[ZnBr_4]$	*or*	12.681(4)		$ZnBr_4$	Br	2.393(3,5)	Br,Br	109.5(1,2.7)	92
(not given)	Pnma	9.239(3)							
	4	16.025(6)							
$(Me_4N)_2$ $[ZnBr_4]$	*m*	12.534(2)		$ZnBr_4$	Br	2.404(10,10)	Br,Br	109.5(5,2.5)	93
(not given)	$P2_1/a$	9.142(3)							
(at 193k)	4	15.772(4)	89.69(2)						
$[ZnBr_4]$ $[Co(C_{12}H_{29}N_5)\cdot Br]$	*m*	8.399(2)		$ZnBr_4$	Br	2.409(1,29)	Br,Br	109.5(1,3.2)	95
(not given)	$P2_1/n$	18.784(3)	103.12(2)						
	4	14.688(3)							
$[ZnBr_4]$ $[Mo(Bu^tNC)_4\cdot$	*or*	43.621(11)		$ZnBr_4$	Br	2.415(4,28)	Br,Br	109.5(2,5.5)	96
$(Bu^tHNC)_2Br]_2$	$P2_12_12_1$	16.912(5)							
(deep red)	4	11.603(3)							
$(Me_4N)_2[Zn(PhSe)_4]$	*m*	12.089(7)		$ZnSe_4$	Se	2.469(2,12)	Se,Se	*109.5(1,10.6)*	97
(colourless)	$P2_1$	14.587(10)	90.84(2)						
	2	9.950(7)							
$(Me_4N)_2$ $[Zn(PhSe)_4]$	*m*	12.042(3)		$ZnSe_4$	Se	2.357(3,21)	Se,Se	109.5(1,9.6)	97
(colourless)	$P2_1$	14.366(1)	90.80(2)						
	2	9.837(2)							
$Zn(Et_2NCSe)_2$	*m*	9.985(10)		$ZnSe_4$	Se	2.441(4,6)	Se,Se	74.9(1,4.2)[g]	98
(pale yellow)	$P2_1/c$	11.017(10)	110.42(5)		Se	2.801(4,233)		97.9(1,8.6)	
	4	16.873(10)							
$(Ph_4P)_2$ $[Zn(C_3Se_5)_2]\cdot MeCN$	*tr*	14.402(3)		$ZnSe_4$	Se	2.443(2,13)	Se,Se	96.5(1,0)[c]	99
(purple)	$P\bar{1}$	19.353(4)	99.59(3)					111.3(1,6)	
	2	9.774(4)						121.6(1,5)	
$(Ph_4P)_2[Zn(CSe_4)_2]\cdot$	*m*	21.586(2)		$ZnSe_4$	Se	2.444(2,18)	Se,Se	100.3(1,3)[c]	99
(red)	$P2_1/n$	24.136(2)	104.87(7)					112.0(1,1.3)	
	4	10.208(4)						120.8(1)	
$[Zn(Se_4)(Se_6)]\cdot[Rb(18\text{-crown-}6)]$	*m*	19.631(4)		$ZnSe_4$	Se	2.458(3,26)	Se,Se	108.6(1)[c]	100
(red)	*C2/c*	11.259(9)	90.05(3)					125.5(1)[g]	
(at 223K)	4	20.603(16)						105.9(1,13.0)	

Table 1 *Continued*

COMPOUND (colour)	Crys.cl. Sp. Grp Z	a[Å] b[Å] c[Å]	α[°] β[°] γ[°]	Chromo-phore		Zn-L [Å]		L-Zn-L [°]	Ref.
$(Me_4N)_2[ZnI_4]$	*m*	9.612(9)		ZnI_4	I	2.607(5,15)	I,I	109.5(2,2.6)	101
(not given)	$P2_1/c$	16.656(15)	90.15(4)						
	4	13.222(18)							
$(Me_4N)_2[ZnI_4]$	*or*	9.639(9)		ZnI_4	I	2.618(2,25)	I,I	109.5(1,2.8)	102
(colourless)	Pmcn	16.722(4)							
	4	13.254(6)							
$(Me_4N)_2[ZnI_4]$	*or*	9.574(3)		ZnI_4	I	2.621(3,14)	I,I	109.5(1,3.3)	102
(colourless)	$Pbc2_1$	33.020(6)							
(at 150K)	8	13.106(3)							
$[Zn\{\eta^3\text{-}HB(3\text{-}Bu^tpz)_3\}H]$	*m*	8.262(1)		ZnN_3H	N	2.082(6,7)	N,N	91.4(2,9)	103
(not given)	*Pn*	15.465(2)	100.76		H	not given	N,H	not given	
	2	9.696(2)							
$[Zn\{\eta^3\text{-}HB(3\text{-}Bu^tpz)_3\}\cdot$	*or*	10.490(1)		ZnN_3O	N	2.081(6,26)	N,N	93.5(3,3.5)	103
(ac)]	$P2_1cn$	15.832(2)			ac O	1.859(6)	N,O	122.3(3,6.9)	
(not given)	4	19.292(3)							
$[Zn\{\eta^3\text{-}HB(3\text{-}Bu^t\text{-}5\text{-}Mepz)_3\}$	*rh*	15.995(2)		ZnN_3O	N	2.052(5,0)	N,N	92.8(2)	104
(OH)]	*R*3*m*	—			HO	1.850(8)	N,O	123.2(2)	
(colourless)	3	9.391(2)	100						
$[Zn(3,5\text{-}Me_2pz)\cdot$	*tr*	12.932(3)	90.91(4)	ZnN_3O	N	1.995(5)	N,N	115.7(2,4.2)	105
$(C_{18}H_{23}N_5)(NO_3)]\cdot$	$P\bar{1}$	15.402(15)	108.61(2)		N	1.998(5,17)	N,O	101.8(2,11.5)	
NO_3[e]	4	15.451(2)	107.03(4)		O_2NO	2.033(5)			
(white)				ZnN_3O	N	1.990(5)	N,N	116.1(2,3.3)	
					N	2.008(5,19)	N,O	101.1(2,12.0)	
					O_2NO	2.061(5)			
$[Zn\{\eta^3\text{-}HB(3\text{-}Bu^tpz)_3\}\cdot(CN)]$	*or*	16.315(3)		ZnN_3C	N	2.045(5,4)	N,N	94.1(2,3)	106
(white)	Pnma	15.852(3)			NC	1.962(6)	N,C	121.8(2,1.2)	
	4	9.757(2)							
$[Zn\{\eta^3\text{-}HB(3\text{-}Bu^tpz)_3\}\cdot$	*or*	16.235(2)		ZnN_3C	N	2.042(4,5)	N,N	94.2(1,4)	106
$(CN)_{0.8}Cl_{0.2}]$	Pnma	15.871(3)			NC	2.094(4)	N,C	121.9(1,8)	
(white)	4	9.760(1)							
$Zn\{\eta^3\text{-}HB(3\text{-}Bu^tpz)_3\}\cdot$	*or*	16.303(4)		ZnN_3C	N	2.042(4,3)	N,N	94.1(2,3)	106
$(CN)_{0.95}Br_{0.05}$	Pnma	15.847(6)			NC	2.035(6)	N,C,	121.9(2,1.0)	
(white)	4	9.752(3)							
$Zn_2\{\eta^3\text{-}HB(3\text{-}Bu^tpz)_3\}\cdot$	*or*	16.315(6)		ZnN_3C	N	2.043(4,8)	N,N	93.9(2,1.3)	106
$(CN)_{0.9}I_{0.1}$	Pnma	15.841(8)			NC	1.932(12)	N,C	122.0(5,7)	
(white)	4	9.751(4)			I	2.469(8)			

Table 1 *Continued*

COMPOUND (colour)	Crys.cl. Sp. Grp *Z*	*a*[Å] *b*[Å] c[Å]	α[°] β[°] γ[°]	Chromo-phore		Zn-L [Å]		L-Zn-L [°]	Ref.
$[Zn\{(4,5\text{-}Pr^{i}im)_3P\}\cdot Cl]$	*or*	10.323(5)		ZnN_3Cl	N	2.057(2,0)	N,N	96.4(7,1.1)	107
$Cl\cdot 2dmf$	Pnma	18.648(9)			Cl	2.170(2)	N,Cl	120.7(1,1.0)	
(not given)	4	22.220(15)							
$[Zn(C_9H_{21}N_3)Br]\cdot Br$	*or*	14.605(2)		ZnN_3Br	N	2.039(7,21)	N,N	104.9(3,8)	108
(white)	Pbca	12.974(2)			Br	2.359(1)	N,Br	113.7(2,2.7)	
	8	15.050(2)							
$(Et_2NCH_2Ph)\cdot$	*or*	24.770(5)		$ZnCl_3O$	Cl	2.243(3,17)	Cl,Cl	113.5(1,9)	109
$[ZnCl_3(H_2O)]$	Pcab	17.341(3)			H_2O	2.054(6)	Cl,O	103.5(2,2.0)	
(not given)	8	8.284(3)							
$[ZnCl_3(thf)]\cdot$	*tr*	8.330(3)	98.50(2)	$ZnCl_3O$	Cl	2.241(16,15)	Cl,Cl	110.8(4,2.0)	110
$[VCl_2(thf)_2(H_2O)_2]\cdot thf$	$P\bar{1}$	20.222(9)	97.82(2)		O	2.025(3)	Cl,O	104.6(1,3)	
(green)	2	8.161(2)	99.85(2)						
$[ZnCl_3(thf)]\cdot[Ti(thf)_4Cl_2]$	*or*	21.970(12)		$ZnCl_3O$	Cl	2.24(3,2)	Cl,Cl	114.8(1,2.0)	111
(blue green)	$P2_12_12_1$	9.065(3)			O	2.121(8)	Cl,O	103.2(3,1.0)	
	4	14.134(5)							
$ZnCl_3(C_5H_5N_4)$	*m*	8.896(1)		$ZnCl_3N$	Cl	2.238(11,16)	Cl,Cl	110.7(1,1.2)	47
(colourless)	$P2_1/c$	9.810(2)	101.27(2)		N	2.054(3)	Cl,N	108.2(1,8.5)	
	4	11.544(2)							
$ZnCl_3(C_5H_6N_5)$	*m*	10.847(2)		$ZnCl_3N$	Cl	2.229(2,25)	Cl,Cl	111.2	112
(colourless)	$P2_1/c$	5.934(1)	90.95(2)		N	2.094(5)	Cl, N	107.5	
	4	15.726(2)							
$ZnCl_3(C_4H_5N_6)$	*tr*	6.516(16)	107.13(12)	$ZnCl_3N$	Cl	2.240(6,27)	Cl,Cl	106.8(3,4.4)	113
(colourless)	$P\bar{1}$	10.389(25)	86.01(11)		N	2.073(11)	Cl,N	111.9(2,3.3)	
	2	7.736(17)	93.31(11)						
$[ZnCl_3(thiamine)]\cdot$	*m*	25.747(8)		$ZnCl_3N$	Cl	2.259(1,11)	Cl,Cl	110.1(5,2.7)	114
$0.4\ H_2O$	C2/*c*	8.453(3)	105.08(1)		N	2.040(3)	Cl, N	108.8(1,5.7)	
(colourless)	8	17.402(4)							
$ZnCl_3(C_{12}H_{13}N_2O)$	*or*	11.975(4)		$ZnCl_3N$	Cl	2.244(3,3)	Cl,Cl	113.8(1,4.5)	115
(yellow)	Pbca	16.403(6)			N	2.055(8)	Cl, N	104.5(2,5)	
	8	15.848(7)							
$[ZnCl_3py]\cdot[V(salen)(py)_2]$	*tr*	15.155(3)	93.28(2)	$ZnCl_3N$	Cl	2.237(6,21)	Cl,Cl	113.2(2,1.5)	116
(red)	*P*1	12.960(3)	105.46(2)		N	2.13(1)	Cl, N	105.3(4,1.3)	
	2	9.065(2)	106.89(2)						

Table 1 *Continued*

COMPOUND (colour)	Crys.cl. Sp. Grp Z	a[Å] b[Å] c[Å]	α[°] β[°] γ[°]	Chromo-phore		Zn-L [Å]		L-Zn-L [°]	Ref.
$Zn(tu)_3SO_4$	*or*	11.126(5)		ZnS_3O	tuS	2.321(4,12)	S,S	109.4(1,7.0)	117
(not given)	$Pca2_1$	7.773(4)			O_3SO	1.975(9)		109.3(3,4.6)	
	4	15.491(5)							
$[Zn\{(Pr^iO)_2PS_2\}_2\cdot(py)]$	*m*	16.289(3)		ZnS_3N	S	2.273(2)	S,S	85.03(4)[f]	118
(white)	$P2_1$	8.331(2)	99.56(2)		S	2.424(2,72)		116.3(1,12.2)	
	4	21.316(3)			pyN	2.028(4)	S,N	109.4(1,8.7)	
$\{pyH\}[ZnBr_{3/2}\cdot Cl_{3/2}(py)]$	*m*	12.728(1)		$ZnBr_3N$	Br	2.394(1,1)	Br,Br	113.4(–,4)	119
(colourless)	$P2_1/c$	11.600(1)	107.38(1)		N	2.073(1)	Br,N	105.2(1,11)	
	4	13.354(1)		$ZnCl_3N$	Cl	2.251(2,4)	Cl,Cl	113.3(–,5)	
					N	2.073(1)	Cl,N	105.4(–,1.6)	
(4-MepyH)$[ZnBr_3(PPh_3)]$	*m*	10.021(12)		$ZnBr_3P$	Br	2.384(14,27)	Br,Br	112.3(4,3.5)	120
(white)	$P2_1/c$	9.827(15)	101.30(7)		P	2.425(9)	Br,P	106.2(4,5.0)	
	4	26.674(40)							
$\{(C_5H_8)_2SMe\}\cdot[Zn\{(C_5H_{11})_2$	*m*	15.03(5)		ZnI_3C	I	2.64(1,4)	I,I	108.7(4,2.3)	121
$SCH_2\}\cdot I_3]$	$P2_1/c$	15.19(5)	116.2		C	2.14(3)	I,C	110(1,10)	
(colourless)	4	16.97(5)							
$Zn(ac)_2(im)_2$	*tr*	8.065(3)	99.81(2)	ZnO_2N_2	O	1.972(1,15)	O,O	104.8	122
(not given)	$P\bar{1}$	11.322(2)	86.31(3)		N	2.003(2,3)	N,N	109.9	
	2	7.736(2)	92.34(2)				O,N	110.3(–,14.4)	
$Zn(pr)_2(im)_2$	*tr*	7.842(4)	75.72(1)	ZnO_2N_2	O	1.956(2,18)	O,O	106.4	94
(not given)	$P\bar{1}$	8.164(2)	96.55(2)		N	2.009(2,8)	N,N	110.3	
	2	12.392(2)	94.47(3)				O,N	109.5(–,13.1)	
$Zn(m\text{-}HOC_6H_4CO_2)_2\cdot(py)_2$	*m*	21.42(2)		ZnO_2N_2	O	2.01(1,2)	O,O	107.9(5)	123
(colourless)	$P2_1/n$	10.55(1)	101.73(7)		N	2.08(2,0)	N,N	108.5(6)	
	4	14.41(1)					O,N	108.5(6,17.5)	
$Zn(NO_3)_2(py)_2$	*m*	10.27(3)		ZnO_2N_2	O	2.046(13,2)	O,O	96.3(5)	124
(not given)	$P2_1/n$	18.93(3)	122.8(2)		N	2.032(12,16)	N,N	114.4(5)	
	4	16.15(3)					O,N	110.9(5,14.3)	
$[Zn(NO_3)_2(py)_2]\cdot py$	*m*	12.60(3)		ZnO_2N_2	O	2.232(13)	O,O	87.2(3)	125
(not given)	$C2/c$	9.40(3)	108.9(2)		N	2.165(12,36)	N,N	95.3(3)	
	4	16.27(3)					O,N	112.5(3,23.3)	
$Zn\{(MeHNCH_2)_2CMe\}\cdot(ClO_4)_2$	*m*	8.602(3)		ZnO_2N_2	O	1.950(3,14)	O,O	108.8(1)	22[b]
(colourless)	$P2_1/c$	25.638(4)	102.52(4)		N	2.047(4,8)	N,N	100.5(1)[d]	
	4	8.215(7)					O,N	111.7(1,15.8)	

Table 1 *Continued*

COMPOUND (colour)	Crys.cl. Sp. Grp Z	*a*[Å] *b*[Å] c[Å]	α[°] β[°] γ[°]	Chromo-phore		Zn-L [Å]		L-Zn-L [°]	Ref.
$Zn(C_{12}H_{14}NO_2)_2$	*m*	12.034(3)		ZnO_2N_2	O	1.913(2,0)	O,O	109.6(2)	126
(colourless)	*A*2	5.640(3)	117.89(3)		N	1.976(2,0)	N,N	109.0(2)	
	2	19.359(3)					O,N	95.2(1)[d]	
								125.6(2)	
$Zn(MePhsal)_2$	*m*	21.877(3)		ZnO_2N_2	O	1.910(3,0)	O,O	120.8(1)	127
(yellow)	*C*2/*c*	8.801(2)	96.55(3)		N	2.007(3,0)	N,N	124.1(1)	
	?	12.027(5)					O,N	97.5(1)[d]	
								109.4(1)	
$Zn(Etsal)_2$	*m*	13.690(3)		ZnO_2N_2	O	1.902(1,0)	O,O	not given	128
(yellow)	$P2_1/c$	13.615(5)	101.84(1)		N	1.986(1,0)	N,N	not given	
	8	19.445(8)					O,N	97.2(1)[d]	
$Zn(Pr^isal)_2$	*or*	19.488(6)		ZnO_2N_2	O	1.912(1,0)	O,O	not given	128
(yellow)	Pbca	15.140(5)			N	2.009(2,0)	N,N	not given	
	8	13.226(4)					O,N	96.8(1)[d]	
$Zn(Busal)_2$	*tg*	14.338		ZnO_2N_2	O	1.912(1,0)	O,O	not given	128
(yellow)	*P*4	—			N	1.991(1,0)	N,N	not given	
	2	5.374(2)					O,N	96.4(1)[d]	
$Zn(PrMeOsal)_2$	*or*	20.529(6)		ZnO_2N_2	O	1.924(5)	O,O	not given	128
(yellow)	$P2_12_12_1$	20.165(6)			N	1.981(1,0)	N,N	not given	
	4	5.378(2)					O,N	96.4(2)[d]	
$Zn(PrEtsal)_2$	*m*	21.236(8)		ZnO_2N_2	O	1.931(1,0)	O,O	not given	128
(yellow)	C2	5.356(2)	120.84(2)		N	1.943(1,0)	N,N	not given	
	2	13.289(4)					O,N	95.8(1)[d]	
$Zn(nimMe)_2$	*tr*	10.236(2)	120.42(2)	ZnO_2N_2	O	1.942(4,7)	O,O	127.6(1)	129
(yellow)	$P\bar{1}$	11.838(3)	84.54(2)		N	1.984(3,5)	N,N	122.2(2)	
	2	11.914(2)	109.11(2)				O,N	95.0(2,5)[d]	
Zn(nimCOOEt)	*m*	20.233(9)		ZnO_2N_2	O	1.94(1,0)	O,O	not given	129
(yellow)	Pn	6.162(2)	90.08(3)		N	1.985(22,55)	N,N	not given	
	2	11.284(3)					O,N	93.9(6,3)[d]	
Zn(nimPh)	*m*	12.908(8)		ZnO_2N_2	O	1.936(4,1)	O,O	123.3(2)	129
(yellow)	$P2_1/c$	19.348(12)	110.55(4)		N	1.972(4,5)	N,N	125.5(2)	
	4	12.832(9)					O,N	109.9(2,1.1)	
$Zn(C_{16}H_{24}O_5)(Ph)_2$	*m*	14.775(3)		ZnO_2C_2	O	2.308(3,85)	O,O	73.0(9,4)[c]	130
(colourless)	$P2_1/n$	18.252(3)	103.29(1)		PhC	1.958(4,14)	C,C	147.7(2,2.2)	
	8	20.082(1)					O,C	102.9(1,6.1)	
$Zn(C_{14}H_{19}O_4Br)(Ph)_2$	*m*	9.800(1)		ZnO_2C_2	O	2.269(6.5)	O,O	71.6(2)[c]	130
(colourless)	$P2_1/n$	12.887(1)	95.66(1)		PhC	1.961(8.2)	C,C	139.6(3)	
	4	19.671(2)					O,C	106.2(3,4.6)	

Table 1 *Continued*

COMPOUND (colour)	Crys.cl. Sp. Grp Z	a[Å] b[Å] c[Å]	α[°] β[°] γ[°]	Chromo-phore		Zn-L [Å]		L-Zn-L [°]	Ref.
$Zn(C_{16}H_{23}O_5Br)(Ph)_2$		9.368(1)		ZnO_2C_2	O	2.284(3,45)	O,O	72.4(1)[c]	130
(colourless)		10.975(1)	97.48(2)		PhC	1.964(4,3)	C,C	146.7(2)	
		27.051(2)					O,C	103.3(2,1.3)	
$Zn(C_{12}H_{22}O_2)\cdot(CH_2I)_2^{\S}$	*tr*	7.367(7)	105.42(4)	ZnO_2C_2	O	2.15(1,5)	O,O	72.7(4)[c]	131
(not given)	*P*1	11.108(4)	91.67(3)		C	1.95(2,3)	C,C	138.4(7)	
	2	11.728(5)	94.57(3)				O,C	106.6(6,2.9)	
				ZnO_2C_2	O	2.22(1,2)	O,O	7.17(4)[c]	
					C	2.02(2,1)	C,C	137.5(6)	
							O,C	107.1(5,9)	
$[Zn(H_2O)_2Cl_2]\cdot(C_{10}H_{20}O_5)$	*m*	8.294(2)		ZnO_2Cl_2	H_2O	1.996(4,6)	O,O	98.5(2)	132
(colourless)	$P2_1/c$	13.576(3)	99.48(2)		Cl	2.197(2,7)	Cl,Cl	122.5(1)	
	4	15.784(3)					O,Cl	108.3(1)	
$Zn(dmf)_2Cl_2$	*m*	13.296(4)		ZnO_2Cl_2	O	1.998(2,5)	O,O	100.13(7)	133
(colourless)	*C*2/*c*	13.254(4)	113.76(3)		Cl	2.208(1,5)	Cl,Cl	121.68(3)	
	8	14.702(6)					O, Cl	105.7(1,5.5)	
$Zn(pyNO)_2Cl_2$	*m*	12.318(4)		ZnO_2Cl_2	O	1.992(2,0)	O,O	106.8(2)	134
(not given)	*Fdd*2	28.176(6)			Cl	2.214(1,0)	Cl,Cl	119.5(1)	
	8	7.268(2)					O,Cl	107.5(1,1.1)	
$Zn(2,6\text{-}Me_2pyNO)_2Cl_2$	*m*	14.167(8)		ZnO_2Cl_2	O	2.01(1,0)	O,O	94.7(1)	135
(colourless)	*C*2/*c*	8.419(5)	96.15(5)		Cl	2.246(1,0)	Cl,Cl	114.8(2)	
	4	14.625(8)					O,Cl	111.4(3,4)	
$Zn(L\text{-}pro)_2Cl_2$	*or*	13.527(3)		ZnO_2Cl_2	O	1.975(3,9)	O,O	97.47(13)	136
(colourless)	$P2_12_12_1$	16.263(3)			Cl	2.254(2,21)	Cl,Cl	108.65(5)	
	4	6.598(1)					O,Cl	112.0(1,9.6)	
$[Zn(but)_2Cl_2]\cdot H_2O$	*or*	9.269(5)		ZnO_2Cl_2	O	1.965(7,0)	O,O	92.2(4)	137
(colourless)	Imm2	11.860(6)			Cl	2.231(6,0)	Cl,Cl	115.5(2)	
	2	8.137(4)					O,Cl	111.7(1)	
$Zn(pybet)_2Cl_2$	*tr*	7.313(1)	75.86(2)	ZnO_2Cl_2	O	1.976(3,12)	O,O	103.9(1)	137
(colourless)	$P\bar{1}$	8.734(3)	76.66(2)		Cl	2.250(2,12)	Cl,Cl	108.7(1)	
	2	10.667(4)	81.40(2)				O,Cl	111.1(1,3.8)	
$Zn(pybet)(H_2O)Cl_2$	*tr*	6.1663(3)	82.944(9)	ZnO_2Cl_2	O	1.936(1)	O,O	104.7(1)	137
(colourless)	$P\bar{1}$	8.6674(9)	89.010(7)		H_2O	2.051(1)	Cl,Cl	115.9(1)	
	2	9.783(1)	83.740(7)		Cl	2.225(1,6)	O,Cl	108.6(1,9.2)	

Table 1 *Continued*

COMPOUND (colour)	Crys.cl. Sp. Grp *Z*	*a*[Å] *b*[Å] c[Å]	α[°] β[°] γ[°]	Chromo-phore		Zn-L [Å]		L-Zn-L [°]	Ref.
$Zn(Ph_3PO)_2Cl_2$	*or*	20.728(2)		ZnO_2Cl_2	O	1.984(6,0)	O,O	96.8(2)	138
(colourless)	*Fdd*2	33.042(7)			Cl	2.204(2,0)	Cl,Cl	116.4(1)	
	8	9.769(2)					O,Cl	112.7(2,3.7)	
$Zn(Ph_3PO)_2Cl_2$	*or*	32.95(1)		ZnO_2Cl_2	O	1.967(5,5)	O,O	97.0(3)	139
(colourless)	*Fdd*2	20.702(6)			Cl	2.187(2,2)	Cl,Cl	117.2(1)	
	8	9.792(3)					O,Cl	110.2(1,1.5)	
$Zn(apy)_2Cl_2$	*m*	9.35(1)		ZnO_2Cl_2	O	2.008(6,11)		not given	140
(colourless)	$P2_{1/c}$	19.07(1)	100.2(3)		Cl	2.245(4,4)			
	4	13.88(1)							
$Zn(dma)_2Cl_2$	*or*	9.922(2)		ZnO_2Cl_2	O	1.969(8,6)	O,O	90.5(3)	141
(colourless)	$P2_12_12_1$	17.797(3)			Cl	2.214(4,6)	Cl,Cl	115.7(1)	
	4	8.005(2)					O,Cl	116.9(3,1.9)	
$Zn(H_2O)_2(C_6H_5COS)_2$	*m*	9.836(10)		ZnO_2S_2	H_2O	2.031(6,0)	O,O	94.5(2)	142
(not given)	*C*2	6.809(1)	108.12(10)		S	2.278(2,0)	S,S	125.7(2)	
	2	11.915(10)					O,S	108.2(2,7.0)	
$Zn(ac)_2(tu)_2$	*m*	6.938(3)		ZnO_2S_2	O	1.964(8,10)	O,O	101.0(3)	143
(not given)	$P2_1/c$	17.678(6)	112.47(18)		S	2.294(4,33)	S,S	114.3(1)	
	4	11.795(6)					O,S	108.8(2,11.7)	
$Zn(Cl_3ae)_2(tu)$	*m*	5.972(2)		ZnO_2S_2	O	2.008(5,5)	O,O	100.01(2)	144
(colourless)	$P2_1/c$	23.103(11)	102.91(3)		S	2.304(2,12)	S,S	123.3(1)	
	4						O,S	107.7(2,5.5)	
$Zn(pr)_2(tu)_2$	*rh*	25.058(4)		ZnO_2S_2	O	1.974(2,15)	O,O	101.9(1)	145
(colourless)	*R*3*c*	—			S	2.331(2,11)	S,S	105.2(1)	
	18	13.585					O,S	112.1(1,13.3)	
$Zn(OEtCOCH{=}CSMe)_2$	*m*	11.107(1)		ZnO_2S_2	O	2.004(4,3)	O,O	96.8(1)	146
(colourless)	$P2_1/c$	18.239(2)	107.7(1)		S	2.246(2,2)	S,S	126.8(1)	
	4	8.438(1)					O,S	99.3(1)[a]	
								121.1(1,5.8)	
$[Zn(H_2O)_2Br_2]\cdot$	*or*	9.063(4)		ZnO_2Br_2	O	2.00(5,10)	O,O	101.9(4)	147
$(C_{10}H_{20}O_5)$	$Pbn2_1$	15.504(6)			Br	2.34(1,1)	Br,Br	120.8(1)	
(colourless)	4	13.030(3)					O,Br	108.1(1,11.2)	
$Zn(Ph_3PO)_2Br_2$	*tr*	10.188(1)	114.58(1)	ZnO_2Br_2	O	1.968(10,3)	O,O	100.9(4)	139
(not given)	*P*1	9.987(1)	121.29(1)		Br	2.356(2,2)	Br,Br	116.6(1)	
	1	11.189(1)	89.82(1)				O,Br	109.6(2,6.3)	
$Zn(D\text{-}pen)_2Br_2$	*m*	15.423(3)		ZnO_2Br_2	O	1.965(2,2)	O,O	93.4(1)	148
(not given)	*C*2	6.406(2)	116.36(2)		Br	2.369(1,1)	Br,Br	109.8(1)	
	2	11.131(3)					O,Br	113.3(1,3.8)	

Table 1 *Continued*

COMPOUND (colour)	Crys.cl. Sp. Grp Z	a[Å] b[Å] c[Å]	α[°] β[°] γ[°]	Chromo-phore		Zn-L [Å]	L-Zn-L [°]		Ref.
$Zn(DL\text{-}pen)_2Br_2$	*m*	22.071		ZnO_2Br_2	O	1.952(3,3)	O,O	93.0(2)	148
(not given)	*C2/c*	6.317(1)	102.24(2)		Br	2.370(1,1)	Br,Br	110.8(1)	
	4	13.938(2)					O,Br	113.0(1,2.3)	
$[Zn(H_2O)_2I_2]\cdot$	*m*	9.386(1)		ZnO_2I_2	O	2.002(7,15)	O,O	102.9(3)	149
$(C_{12}H_{24}O_6)\cdot H_2O$	$P2_1/c$	13.612(2)	115.76(5)		I	2.543(1,1)	I,I	122.2(1)	
(not given)	4	20.058(2)					O,I	107.6(2,6.3)	
$Zn(dmf)_2I_2$	*m*	14.119(8)		ZnO_2I_2	O	2.00(3,1)	O,O	99.7(3)	150
(pale yellow)	*C2/c*	13.725(6)	111.34(4)		I	2.530(3,3)	I,I	121.99	
	8	15.884(6)					O,I	108.2(4,1.0)	
$Zn(pyNO)_2I_2$	*m*	14.319		ZnO_2I_2	O	1.985(5,0)	O,O	115.4(4)	151
(not given)	$P2_1/c$	13.362	102.68		I	2.57(1,0)	I,I	118.7(1)	
	4	8.192					O,I	105.7(3,8.4)	
$Zn(C_8H_{15}NO)_2I_2$	*or*	15.798(8)		ZnO_2I_2	O	not given	O,O	104(1)	152
(white)	$Pna2_1$	10.374(4)			I	2.564	I,I	120.8(2)	
	12	44.26(1)					O,I	not given	
$Zn(MeCN)_2Cl_2$	*or*	12.83		ZnN_2Cl_2	N	2.0	N,N	not given	153
(not given)	*P*nma	10.04			Cl	2.17	Cl,Cl	131.0	
	4	6.65					N,Cl	not given	
$Zn(MeCN)_2Cl_2$	*or*	10.077(1)		ZnN_2Cl_2	N	2.046(3,0)	N,N	95.2(2)	154
(colourless)	Pmcn	6.663(1)			Cl	2.199(2,1)	Cl,Cl	120.7(1)	
	4	12.848(1)					N,Cl	109.5(1,1)	
$Zn(py)_2Cl_2$	*m*	8.44		ZnN_2Cl_2	N	2.005(10,15)	N,N	106.0(2)	155
(colourless)	?	17.45	102.0		Cl	2.185(10,5)	Cl,Cl	121.0(2)	
	?	8.25					N,Cl	106.7(2,2.3)	
$Zn(py)_2I_2$	*m*	8.580(3)		ZnN_2Cl_2	N	2.049(6,3)	N,N	106.3(2)	156
(colourless)	$P2_1/c$	17.677(11)	101.42(4)		Cl	2.222(2,7)	Cl,Cl	120.9(1)	
	4	8.397(5)					N,Cl	107.2(2,9)	
$Zn(4\text{-}Mepy)_2Cl_2$	*m*	14.294(13)		ZnN_2Cl_2	N	2.044(5,2)	N,N	109.9(2)	157
(colourless)	$P2_1/c$	7.885(8)	100.60(5)		Cl	2.207(2,4)	Cl,Cl	121.8(1)	
	4	13.474(1)					N,Cl	108.1(2,1.8)	
$Zn(4\text{-}acpy)_2Cl_2$	*m*	19.340(15)		ZnN_2Cl_2	N	2.051(9,10)	N,N	109.0(4)	158
(colourless)	*C2/c*	18.084(18)	100.13(5)		Cl	2.211(3,5)	Cl,Cl	123.6(1)	
	8	9.678(6)					N,Cl	107.5(3,3.3)	

Table 1 *Continued*

COMPOUND (colour)	Crys.cl. Sp. Grp *Z*	*a*[Å] *b*[Å] c[Å]	α[°] β[°] γ[°]	Chromo-phore		Zn-L [Å]		L-Zn-L [°]	Ref.
$Zn(4\text{-}CNpy)_2Cl_2$	*m*	17.229(2)		ZnN_2Cl_2	N	2.064(6,5)	N,N	105.0(2)	158
(colourless)	*I2/a*	7.443(9)	90.53(1)		Cl	2.212(2,6)	Cl,Cl	125.7(1)	
	8	22.500(3)					N,Cl	106.1(2,1.7)	
$Zn(4\text{-}vipy)_2Cl_2$	*tr*	7.501(4)	90.4(4)	ZnN_2Cl_2	N	2.047(5.7)	N,N	101.9(2)	158
(colourless)	$P\bar{1}$	7.522(5)	90.53(4)		Cl	2.209(2,5)	Cl,Cl	118.7(2)	
	2	14.482(6)	105.29(5)				N,Cl	108.7(2,2.1)	
$Zn(p\text{-}tol)_2Cl_2$	*m*	12.44(5)		ZnN_2Cl_2	N	not given		not given	159
(colourless)	*C*2	4.78(2)	93.3(3)		Cl	2.35(5,0)			
	4	26.2(1)							
$Zn(im)_2Cl_2$	*m*	7.956(5)		ZnN_2Cl_2	N	2.008(3,13)	N,N	105.2(5)	160
(colourless)	$P2_1/c$	11.856(5)	113.58(2)		Cl	2.249(11,10)	Cl,Cl	111.4(1)	
	4	12.078(5)					N,Cl	100.0(3,4.5)	
$Zn(C_6H_5N_3)_2Cl_2$	*m*	7.747(4)		ZnN_2Cl_2	N	2.024(2,10)	N,N	107.23(9)	161
(colourless)	$P2_1/n$	13.982(2)	92.58(2)		Cl	2.238(1,3)	Cl,Cl	113.14(4)	
	4	13.791(2)					N,Cl	108.5(1,3.3)	
$Zn(3,5\text{-}Me_2p_z)_2Cl_2$	*m*	15.013(2)		ZnN_2Cl_2	N	2.018(2,1)	N,N	103.5(1)	162
(colourless)	*C2/c*	8.300(2)	95.85(2)		Cl	2.220(1,4)	Cl,Cl	119.2(1)	
	8	23.988(7)					N,Cl	107.9(1,6.5)	
$Zn(C_7H_6N_2)_2Cl_2$	*m*	12.558(3)		ZnN_2Cl_2	N	2.051(2,13)	N,N	100.7(1)	47
(colourless)	$P2_1/c$	9.410(4)	98.46(3)		Cl	2.222(1,10)	Cl,Cl	117.5(1)	
	4	13.320(3)					N,Cl	109.3(1,1.2)	
Zn(2,2`-bpy)Cl_2	*tr*	8.922(1)	93.94(1)	ZnN_2Cl_2	N	2.056(2,8)	N,N	80.3(1)[c]	163
(colourless)	$P\bar{1}$	9.154(1)	94.61(1)		Cl	2.204(1,6)	Cl,Cl	117.1(1)	
	2	7.587(1)	111.30(1)				N,Cl	113.5(1,9.3)	
Zn(2,9-Me_2-phen)Cl_2	*or*	11.23(2)		ZnN_2Cl_2	N	2.067(11,8)	N,N	81.5(3)[c]	164
(white)	*P*nam	17.68(2)			Cl	2.212(3,8)	Cl,Cl	120.3(1)	
	4	7.487(9)					N,Cl	112.1(2,5.5)	
$Zn(C_{18}H_{37}N_3O_2)Cl_2$	*m*	11.192(1)		ZnN_2Cl_2	N	2.086(3,34)	N,N	82.6(1)[c]	165
(white)	$P2_1/n$	13.413(1)	91.04(1)		Cl	2.221(1,5)	Cl,Cl	117.00(4)	
	4	16.093(1)					N,Cl	not given	
$Zn(C_{16}H_{18}N_4O)Cl_2$	*m*	10.262(2)		ZnN_2Cl_2	N	2.006(3,6)	N,N	90.4(1)[d]	166
(white)	$P2_1/n$	14.089(2)	104.14(2)		Cl	2.224(1,19)	Cl,Cl	115.98(4)	
	4	13.274(2)					N,Cl	not given	
$Zn(C_{18}H_{24}N_2O_2)Cl_2$	*or*	11.929(2)		ZnN_2Cl_2	N	2.048(8,2)	N,N	91.0(3)[d]	167
(not given)	$P2_12_12_1$	12.007(2)			Cl	2.217(3,1)	Cl,Cl	120.4(1)	
	4	14.578(4)					N,Cl	110.4(2,3.6)	

Table 1 *Continued*

COMPOUND (colour)	Crys.cl. Sp. Grp Z	a[Å] b[Å] c[Å]	α[°] β[°] γ[°]	Chromo-phore		Zn-L [Å]		L-Zn-L [°]	Ref.
$Zn(Me_4en)Cl_2$	*m*	7.716(3)		ZnN_2Cl_2	N	2.082(9,25)	N,N	87.9(1)[c]	168
(colourless)	$P2_1/c$	13.335(9)	105.59(6)		Cl	2.209(4,5)	Cl,Cl	119.4(2)	
	4	11.545(5)					N,Cl	111.3(4,1.5)	
$Zn(C_{23}H_{35}N_2P)Cl_2$	*tr*	11.206(6)	106.55(3)	ZnN_2Cl_2	N	2.127(1,16)	N,N	88.0(1)[c]	169
(white)	*P*1	12.436(5)	97.80(3)		Cl	2.222(1,35)	Cl,Cl	107.08(2)	
	2	10.005(4)	105.64(3)				N,Cl	111.8(1,7.0)	
$Zn(dmpd)Cl_2$	*m*	6.014(1)		ZnN_2Cl_2	N	2.018(1,0)	N,N	93.6(2)[d]	170
(not given)	$P2_1/m$	7.724(1)	91.32(1)		Cl	2.266(1,24)	Cl,Cl	108.2(1)	
	2	10.483(1)					N,Cl	113.1(1,8.9)	
$Zn\{(MeNCH_2)_3\}(Me)_2$	*or*	13.553(2)		ZnN_2C_2	N	2.410(4,0)	N,N	105.6(2)	171
(white)	*C*mcm	7.399(2)			H_3C	1.987(6,0)	C,C	145.1(2)	
	4	19.738(4)					N,C	100.3(2)	
$Zn(Bu^t\text{-dab})(Me)_2$	*m*	6.980(1)		ZnN_2C_2	N	2.225(7,0)	N,N	75.0[c]	172
(orange)	$P2_1/n$	20.620(2)	90.97(1)		H_3C	2.010(7,0)	C,C	137.3	
	4	10.854(1)					N,C	not given	
$[Zn(2,9\text{-}Me_2phen)(CN)_2]\cdot$	*m*	13.8140(4)		ZnN_2C_2	N	2.057(3,1)	N,N	81.9(1)[c]	173
$(2,9\text{-}Me_2phen)\cdot 3H_2O$	$P2_1/c$	18.0104(7)	114.836(2)		NC	2.010(3,9)	C,C	116.1(1)	
(colourless)	4	12.8026(3)					N,C	113.6(1,6.0)	
$Zn\{2\text{-}(Me_3Si)_2Cpy\}_2$	*m*	24.45(2)		ZnN_2C_2	N	not given		not given	174
(not given)	$P2_1/c$	16.56(2)	107.82(6)		C	2.049(4)			
	8	16.60(1)							
$Zn(N_4Me_4)(C_6F_5)_2$	*or*	7.098(1)		ZnN_2C_2	N	2.19(2,4)		not given	175
(not given)	$P2_12_12_1$	15.926(2)			C	1.95(3,5)			
	4	17.924(3)							
$Zn(CH_2)_3NMe_2$	*or*	17.044(1)		ZnN_2C_2	N	2.307(4,0)	N,N	109.7(1)	176
(not given)	*Fdd*2	24.734(2)			C	1.984(5,0)	C,C	156.4(2)	
	8	6.108(1)					N,C	100.7(1,7.5)	
α-$Zn(py)_2(PhCOS)_2$	*tr*	13.269(3)	112.31(1)	ZnN_2S_2	N	2.11(5,7)	N,N	106.3(2)	177
(colourless)	$P\bar{1}$	12.827(3)	90.70(1)		S	2.30(2,4)	S,S	118.9(7)	
	4	14.966(3)	95.13(2)				N,S	107.2(2,13.7)	
β-$Zn(py)_2(PhCOS)_2$	*or*	8.69(1)		ZnN_2S_2	N	2.08(2,1)	N,N	99.6	178
(colourless)	*P*bc2_1	25.00(1)			S	2.30(1,2)	S,S	99.7	
	4	10.93(1)					N,S	114.6(–,6.7)	
$Zn(pip)_2$	*tr*	10.279(5)	107.44(5)	ZnN_2S_2	N	2.077(7,8)	N,N	105.6(3)	179
$(C_5H_{10}NCOS)_2$	$P\bar{1}$	12.690(5)	92.67(5)		S	2.304(3,10)	S,S	108.2(1)	
(colourless)	2	12.161(5)	117.27(5)				N,S	110.7(2,4.1)	

Table 1 *Continued*

COMPOUND (colour)	Crys.cl. Sp. Grp Z	a[Å] b[Å] c[Å]	α[°] β[°] γ[°]	Chromo-phore		Zn-L [Å]		L-Zn-L [°]	Ref.
$Zn(2,3,5,6\text{-}Me_4C_6HS)_2$	*m*	15.001(4)		ZnN_2S_2	N	2.047(6,10)	N,N	101.9(2)	180
$(1\text{-}Meim)_2$	$P2_1/c$	13.786(4)	114.72(7)		S	2.300(2,2)	S,S	109.46(8)	
(white)	4	15.677(3)					N,S	111.3(2,4.0)	
Zn(bpy)	*or*	12.816(2)		ZnN_2S_2	N	2.099(6,11)	N,N	77.9(2)[c]	180
$(2,4,6,7\text{-}Pr^iC_6H_2S)_2$	$Pbc2_1$	15.581(2)			S	2.255(2,4)	S,S	119.32(8)	
(not given)	4	19.193(2)					N,S	113.1(2,5.7)	
$(Bu^t_4N)[Zn(C_7H_4NS_2)_2\cdot$	*or*	20.292(26)		ZnN_2S_2	N	1.995(6,11)	N,N	122.9(2)	81
$(Me_2NCS_2)]$	$Pca2_1$	9.947(13)			S	2.408(3,3)	S,S	75.10(8)[f]	
(yellow)	4	19.278(24)					N,S	112.2(2,3.9)	
$Zn(phen)(C_7H_7S)_2$	*m*	10.009(3)		ZnN_2S_2	N	2.112(5,8)	N,N	78.7(2)[c]	181
(yellow)	$P2_1/c$	20.12(3)	107.73(1)		S	2.260(2,5)	S,S	126.16(7)	
	4	12.140(4)					N,S	110.5(2,3.2)	
$Zn(bpy)\{(PrO)_2PS_2\}_2$	*tr*	9.020(2)	83.12(2)	ZnN_2S_2	N	2.12(1,3)	N,N	77.4(3)[c]	118
(white)	$P\bar{1}$	8.502(2)	97.96(4)		S	2.346(4,19)	S,S	116.3(1)	
	2	21.267(2)	103.46(2)				N,S	109.0(4,20.3)	
$Zn(en)\{(PrO)_2PS_2\}_2$	*m*	13.402(8)		ZnN_2S_2	N	2.000(16,78)	N,N	86.0(6)[c]	182
(white)	$P2_1/c$	16.470(9)	99.0(1)		S	2.312(5,20)	S,S	108.4(1)	
	4	12.294(7)					N,S	115.1(4,7.5)	
$Zn(C_5H_{10}NO_2S)_2$	*m*	15.119(2)		ZnN_2S_2	N	2.090(1,0)	N,N	104.6(1)	148
(colourless)	*C*2	5.063(1)	114.86(1)		S	2.273(1,0)	S,S	124.6(1)	
	2	11.129(2)					N,S	107.2(1,15.7)	
$Na_2[Zn(L\text{-}cys)_2]\cdot 6H_2O$	*m*	5.206(2)		ZnN_2S_2	N	2.057(3,10)	N,N	112.6(2)	148
(colourless)	*C*2	23.313(3)	95.53(2)		C	2.290(1,7)	S,S	132.7(1)	
	4	15.052(2)					N,S	103.2(1,13.3)	
$Zn(C_5H_9N_2S_2)_2$	*m*	8.471(2)		ZnN_2S_2	N	2.049(3,3)	N,N	113.2(1)	183
(not given)	$P2_1/c$	18.167(4)	109.82(2)		S	2.280(1,0)	S,S	124.73(4)	
	4	11.854(2)					N,S	87.2(1,2)[c]	
								123.8(1,5.2)	
$Zn(C_9H_9N_2S_2)_2$	*m*	12.087(2)		ZnN_2S_2	N	2.074(3,1)	N,N	117.30(12)	183
(not given)	$P2_1/c$	14.611(2)	116.40(1)		S	2.266(1,2)	S,S	125.90(5)	
	4	13.831(2)					N,S	87,5(1,4)[c]	
								121.1(1,7)	
$Zn(C_{12}H_9N_2S)_2$	*m*	9.443(3)		ZnN_2S_2	N	2.175(3,34)	N,N	102.2(1)	184
(violet)	$P2_1/n$	12.355(3)			S	2.256(1,21)	S,S	120.4(1)	
	4	19.050(6)	101.11(3)				N,S	88.1(1,1)[c]	
								131.1(1,3.5)	

Table 1 *Continued*

COMPOUND (colour)	Crys.cl. Sp. Grp Z	a[Å] b[Å] c[Å]	α[°] β[°] γ[°]	Chromo-phore		Zn-L [Å]		L-Zn-L [°]	Ref.
α-$Zn(C_{13}H_{11}N_4S)_2$	*m*	15.21(2)		ZnN_2S_2	N	2.11(2,0)	N,N	110(1)	185
(grey-green)	$P2_1/a$	22.25(3)	91.4(2)		S	2.220(3,0)	S,S	130.9(4)	
	4	7.84(1)					N,S	86.1(7,8)[c]	
α-$Zn(C_{13}H_{11}N_4S)_2$	*m*	7.887(3)		ZnN_2S_2	N	2.071(7,13)	N,N	107.7(3)	186
(not given)	$P2_1/c$	22.40(1)	92.82(3)		S	2.272(3,5)	S,S	130.6(1)	
	4	15.324(6)					N,S	86.7(2,1)[c]	
								123.3(2,3.3)	
β-$Zn(C_{13}H_{11}N_4S)_2$	*m*	7.607(2)		ZnN_2S_2	N	2.059(5,5)	N,N	107.4(2)	186
(not given)	$P2_1/c$	15.66(1)	94.97(3)		S	2.263(2,7)	S,S	129.4(1)	
	4	22.76(1)					N,S	86.4(1,2)[c]	
								124.7(2,3)	
$Zn(C_{13}H_{11}N_4S)_2$	*m*	7.887(6)		ZnN_2S_2	N	2.076(10,2)	N,N	not given	187
(not given)	$P2_1/c$	22.501(17)	92.58(4)		S	2.274(2,11)	S,S	not given	
	4	15.325(11)					N,S	86.64[c]	
$Zn(C_{13}H_{14}NS_2)_2$	*m*	8.153(3)		ZnN_2S_2	N	2.07(2,5)	N,N	109(1)	188
(yellow)	$P2_1/b$	13.474(4)	114.9(1)		S	2.28(1,1)	S,S	123(1)	
	4	25.943(6)					N,S	99(1.1)[d]	
								113(1,1)	
$Zn(C_{10}H_8NS)_2$	*tr*	9.134(2)	89.92(1)	ZnN_2S_2	N	2.118(7,3)	N,N	95.6(2)	189
(not given)	$P\bar{1}$	10.693(2)	104.39(1)		S	2.254(2,6)	S,S	132.5(1)	
	2	9.755(1)	101.86(1)				N,S	89.1(2,4)[c]	
								123.7(2,3)	
$Zn(C_{14}H_{22}N_3S)_2$	*or*	18.776(6)		ZnN_2S_2	N	2.049(3,0)	N,N	106.9(1)	190
(not given)	*B2/b*	10.860(3)			S	2.291(1,0)	S,S	106.4(1)	
	4	15.178(5)					N,S	102.8(1)[d]	
								119.5(1)	
$Zn(H_2NCH_2Me_2CS)_2$	*or*	5.5755(7)		ZnN_2S_2	N	2.06(1,0)	N,N	122.8(6)	191
(not given)	$C222_1$	10.585(1)			S	2.297(4,0)	S,S	137.1(2)	
	4	21.741(3)					N,S	91.5(3)[c]	
								108.9(3)	
$Zn(C_{12}H_{18}N_2S_2)$	*m*	10.988(4)		ZnN_2S_2	N	2.027(2)	N,N	83.2(1)[c]	192
(colourless)	*C2/c*	11.692(2)	116.11(2)		S	2.293(1)	S,S	113.6(1)	
	4	12.227(4)					N,S	96.0(1)[d]	
								135.6(1)	
$Zn(C_{14}H_{22}N_2S_2)$	*m*	12.286(10)		ZnN_2S_2	N	1.997(6,0)	N,N	100.5(3)[g]	193
colourless)	*C2/c*	11.970(10)	120.67(5)		S	2.277(3,0)	S,S	122.8(1)	
	4	12.608(10)					N,S	100.2(2)[d]	
								115.8(2)	

Table 1 *Continued*

COMPOUND (colour)	Crys.cl. Sp. Grp Z	a[Å] b[Å] c[Å]	α[°] β[°] γ[°]	Chromo-phore		Zn-L [Å]		L-Zn-L [°]	Ref.
$Zn(4\text{-}Mepy)_2Br_2$	m	14.42(1)		ZnN_2Br_2	N	2.05(3,0)	N,N	101.6(1.3)	194
(not given)	$P2_1/c$	8.08(1)	101.10(5)		Br	2.35(1,0)	Br,Br	120.9(3)	
	4	13.89(1)					N,Br	108.2(9,2.3)	
$Zn(C_9H_9NO)_2Br_2$	m	7.781(3)		ZnN_2Br_2	N	2.04(1,2)	N,N	90.2(6)	195
(not given)	$P2_1$	10.746(4)	109.22(3)		Br	2.350(3,28)	Br,Br	117.3(1)	
	2	11.823(3)					N,Br	111.4(5,7.1)	
$\beta\text{-}Zn(C_{10}H_{10}N_2)_2Br_2$	m	9.039(1)		ZnN_2Br_2	N	2.033(5,20)	N,N	102.5(2)	196
(white)	$P2_1/n$	21.325(3)	105.40(1)		Br	2.359(1,14)	Br,Br	118.89(4)	
	4	11.521(2)					N,Br	108.6(2,8.0)	
$Zn(dmpd)Br_2$	m	6.234(2)		ZnN_2Br_2	N	2.014(4)	N,N	93.0(2)	170
(not given)	$P2_1/m$	7.968(2)	91.81(3)		Br	2.384(1,34)	Br,Br	107.8(1)	
	2	10.628(2)					N,Br	113.3(1,7.2)	
$Zn(C_{13}H_{18}N_2)Br_2$	m	7.750(2)		ZnN_2Br_2	N	2.066(8,39)	N,N	81.8(2)[c]	197
(not given)	$P2_1/c$	23.044(4)	130.42(2)		Br	2.347(1,2)	Br,Br	115.09(5)	
	4	11.852(3)					N,Br	113.9(3,2.6)	
$Zn(C_{13}H_{20}N_2)Br_2$	tr	7.787(4)	101.91(2)	ZnN_2Br_2	N	2.066(6,5)	N,N	84.4(2)[c]	197
(not given)	$P\bar{1}$	9.855(1)	100.87(2)		Br	2.360(1,3)	Br,Br	110.76(3)	
	2	10.823(4)	88.6(2)				N,Br	114.9(2,8.6)	
$Zn(C_{21}H_{34}N_4O)Br_2$	or	18.554(5)		ZnN_2Br_2	N	2.047(10,6)	N,N	91.3(4)[d]	198
(not given)	$Pna2_1$	18.885(5)			Br	2.362(2,9)	Br,Br	116.5(1)	
	4	8.633(3)					N,Br	111.6(3,1.5)	
$Zn(py)_2I_2$	m	9.316(7)		ZnN_2I_2	N	2.055(10,5)	N,N	99.8(5)	199
(not given)	$P2_1/c$	18.034(9)	100.8(1)		I	2.552(2,1)	I,I	120.32(8)	
	4	8.801(7)					N,I	108.7(4,5)	
$Zn(C_6H_{12}N_4)_2I_2$	or	18.267(1)		ZnN_2I_2	N	2.097(3,0)	N,N	113.2(2)	200
(colourless)	$P2_12_12_1$	6.978(3)			I	2.543(1,0)	I,I	111.5(1)	
	2	7.186(1)					N,I	108.1(1,1.5)	
$Zn(Me_4en)I_2$	m	13.118(8)		ZnN_2I_2	N	2.13(1,0)	N,N	not given	201
(colourless)	$C2/c$	7.811(5)	111.38(4)		I	2.53(–,0)	I,I	114.5(1)	
	4	13.566(8)					N,I	111.4(3)	
$Zn(C_{10}H_{16}N_2)I_2$	m	8.460(6)		ZnN_2I_2	N	2.092(9,8)	N,N	84.6(3)[c]	202
(colourless)	$P2_1/c$	21.079(9)	97.15(5)		I	2.538(2,1)	I,I	115.36(6)	
	4	8.278(4)					N,I	113.1(2,5.2)	
$Zn\{Me_2C(CH_2N(H)Me\}_2I_2$	m	16.935(6)		ZnN_2I_2	N	2.039(20,6)	N,N	92.9(7)[d]	203
(white)	$P2_1/c$	13.831(5)	102.86(3)		I	2.553(3,10)	I,I	118.11(1)	
	8	13.372(5)					N,I	109.7(5,4.3)	

Table 1 *Continued*

COMPOUND (colour)	Crys.cl. Sp. Grp *Z*	*a*[Å] *b*[Å] c[Å]	α[°] β[°] γ[°]	Chromo-phore		Zn-L [Å]		L-Zn-L [°]	Ref.
$Zn(C_{23}H_{27}N_3O_3)I_2$	*m*	10.632(5)		ZnN_2I_2	N	2.083(9,12)	N,N	85.4(3)[c]	204
(colourless)	$P2_1/c$	22.427(12)	114.87(4)		I	2.540(2,21)	I,I	121.1(1)	
	4	11.629(6)					N,I	110.7(2,10.7)	
$Zn\{Ph_2P(CH_2)_3\}_2$	*m*	14.224(6)		ZnC_2P_2	C	2.01(1,1)	C,C	147.1(4)	205
(colourless)	$P2_1/a$	19.340(9)	102.14(3)		P	2.585(3,13)	P,P	105.72(9)	
	4	9.984(2)					C,P	85.7(3,2)[c]	
								114.5(2,3.5)	
$ZnCl_2(tu)_2$	*or*	13.065(3)		$ZnCl_2S_2$	Cl	2.32(1,0)	Cl,Cl	107.3(2)	206
(colourless)	Pnma	12.722(5)			S	2.35(10)	S,S	111.5(2)	
	4	5.890(5)					Cl,S	109.8(2,8)	
$ZnCl_2(Et_2tu)_2$[e]	*m*	10.418(3)		$ZnCl_2S_2$	Cl	2.270(3,7)	Cl,Cl	105.4(1)	207
(colourless)	$P2_1/c$	14,974(3)	92.16(10)		S	2.340(2,3)	S,S	101.4(1)	
	8	24.078(10)					Cl,S	112.3(1,2.8)	
				$ZnCl_2S_2$	Cl	2.263(3,12)	Cl,Cl	107.5(1)	
					S	2.344(3,10)	S,S	99.7(1)	
							Cl,S	112.4(1,2.7)	
$ZnCl_2\{(tolyl)tu\}_2$	*m*	19.868(9)		$ZnCl_2S_2$	Cl	2.245(2,0)	Cl,Cl	119.0(1)	208
(colourless)	*A*2/*a*	25.824(12)			S	2.352(2,0)	S,S	109.0(1)	
	4	8.307(3)	130.64(2)				Cl,S	107.2(1,2.9)	
$ZnCl_2(C_2H_5NS)_2$	*tr*	7.299(2)	78.37(1)	$ZnCl_2S_2$	Cl	2.266(1,14)	Cl,Cl	109.77(5)	209
(white)	$P\bar{1}$	7.6993(6)	85.34(2)		S	2.348(2,10)	S,S	101.02(5)	
	2	10.788(1)	63.63(1)				Cl,S	111.4(1,4.1)	
$ZnCl_2(4\text{-Phtscac})_2$	*m*	18.040(7)		$ZnCl_2S_2$	Cl	2.253(1,35)	Cl,Cl	116.3	210
(colourless)	$P2_1/b$	14.790(6)			S	2.365(1,3)	S,S	108.3	
	4	9.667(4)	95.17(3)				Cl,S	108.0(–,9.3)	
$ZnCl_2(btsc)_2$	*m*	15.090(4)		$ZnCl_2S_2$	Cl	2.270(1,6)	Cl,Cl	114.83(8)	211
(white)	$P2_1/n$	7.739(4)	92.9(1)		S	2.348(1,7)	S,S	112.60(8)	
	4	18.300(4)					Cl,S	107.4(1,7.4)	
$ZnCl_2(dtm)$	*m*	9.346(4)		$ZnCl_2S_2$	Cl	2.268(4,20)	Cl,Cl	108.7(2)	212
(colourless)	$P2_1/c$	23.572(5)	93.40(3)		S	2.342(4,11)	S,S	109.3(1)[h]	
	4	11.684(5)					Cl,S	109.5(2,7.2)	
$ZnCl_2(C_4H_8N_2S_2)$	*or*	13.770(2)		$ZnCl_2S_2$	Cl	2.240(1,0)	Cl,Cl	111.4(1)	213
(not given)	Pbcn	8.210(1)			S	2.371(1,0)	S,S	91.3(1)[c]	
	4	9.056(1)					Cl,S	113.2(1,3.0)	

Table 1 *Continued*

COMPOUND (colour)	Crys. cl. Sp. Grp Z	a[Å] b[Å] c[Å]	α[°] β[°] γ[°]	Chromophore		Zn-L [Å]		L-Zn-L [°]	Ref.
$Zn(dtmm)Br_2$	m	11.482(1)		$Zn_2S_2Br_2$	S	2.343(3,9)		not given	214
(colourless)	$P2_1/a$	24.207(3)	94.43(1)		Br	2.404(2,20)			
	4	9.572(1)							
$Zn(Me_4en)(C_5H_7)Cl$	m	8.435(2)		ZnN_2CCl	N	2.156(6,5)	N,N	84.5(3)[c]	215
(colourless)	$P2_1/c$	13.587(2)	96.50(2)		C	2.03(12)	N,C	119.1(4,9)	
	4	12.096(2)			Cl	2.263(3)	N,Cl	104.8(2,3)	
							C,Cl	118.8(4)	
$[ZnCl_2(H_2O)\cdot$	m	9.805(3)		$ZnCl_2ON$	Cl	2.201(3,42)	Cl,Cl	119.7(1)	216
$(C_{18}H_9N_4O_2P)]$	$P2_1/c$	26.202(7)	111.79(2)		H_2O	2.037(5)	Cl,O	108.5(2,5.4)	
(colourless)	4	10.924(3)			N	2.025(6)	Cl,N	113.4(2,8)	
							O,N	87.3(2)	
$ZnCl_2(atsc)$	m	7.823(2)		$ZnCl_2NS$	Cl	2.227(2,25)	Cl,Cl	111.07(7)	217
(colourless)	$P2_1/n$	14.310(2)	100.32(2)		N	2.216(4)	Cl,N	109.3(1,4.6)	
	4	8.691(2)			S	2.303(2)	Cl,S	119.0(1,2.6)	
							N,S	85.2(1)[c]	
$ZnCl_2(tsc)$[e]	*or*	11.92(1)		$ZnCl_2NS$	Cl	2.238(10,0)	Cl,Cl	106.3(5)	218
(colourless)	Pnma	7.28(2)			N	2.11(2)	Cl,N	106.4(4)	
	8	15.46(2)			S	2.286(6)	Cl,S	115.6(2)	
							N,S	89.1(7)[c]	
				$ZnCl_2NS$	Cl	2.247(9,0)	Cl,Cl	110.7(5)	
					N	2.08(3)	Cl,N	108.3(5)	
					S	2.298(6)	Cl,S	121.8(2)	
							N,S	90.5(8)[c]	
$(Bu_4N)[Zn(C_7H_4NS)_3$	m	9.854(5)		ZnS_2ON	S	2.338(2,11)	S,S	120.98(7)	81
$(H_2O)]$	$P2_1/c$	16.027(13)	94.325(6)		N	2.019(4)	S,N	111.1(1,5.2)	219
(pale yellow)	4	27.008(22)			H_2O	2.037(4)	S,O	103.7(1,2)	
							N,O	104.3(1)	

[a] Where more than one chemically equivalent distance or angle is present, the mean value is tabulated. The first number in parenthesis is e.s.d., the second is a maximum deviation from the mean value. [b] The chemical identity of coordinated atom (ligand) is specified in these columns. [c] Five-membered metallocyclic ring. [d] Six-membered metallocyclic ring. [e] There are two crystallographically independent molecules. [f] Four-membered metallocyclic ring. [g] Seven-membered metallocyclic ring. [h] Eight-membered metallocyclic ring.

angles are 93.1(3.1,11.9)° for N-donors and 104.3° for the S-donor. In seven-membered rings the corresponding angles are 100.5° for the N-donor and 117.5° for the S-donor. Where hetero-bidentate ligands are involved the mean L-Zn-L' angles for five- and six-membered rings are: 87.6(1.9, 3.9)° (N + S donors) for the former and 96.0(1.0,1.5)° (O + N donors), 99.3° (O + S donors), and 99.5(3.5,3.5)° (N + S donors) for the latter. This again reflects the differing covalent radii of the donor atoms.

Comparison of the Zn-L bond distances shows several trends, unidentate ligands giving shorter values than bidentate ones, but both increasing with increasing radius of the donor atom. For example the values for unidentate ligands are 1.913Å (LO, 0.73Å) < 2.047Å (LN, 0.75Å) < 224.7Å (Cl, 0.99Å), < 232.OÅ (LS, 1.02Å), < 237.4Å(Br, 1.14Å), < 241.3 Å (Se, 1.16Å) < 257.0Å (I, 1.33Å). The values for bidentate ligands are: 2.066Å (LN) < 2.246Å (LO) < 2.317Å (LS) < 2.447Å (LSe). The mean Zn-N bond distance of 1.993Å found for tetradentate N-donor ligands (tetrahedral) is shorter than that found for the square-planar complexes (2.031Å), as expected.

The same effect is also observed for the hetero-bidentate ligands, for example: O + N, 1.923 and 1.980Å, respectively; O + S, 2.004 and 2.246Å; N + S, 2.091 and 2.275Å. For the hetero-tetradentate N + S ligands the mean values are 2.012 and 2.285Å, respectively.

The ZnX_4^{-2} (X = Cl, Br or I) complexes were isolated as salts of large cations. In general there are two types of these cations, organic moieties (mostly NR_4^+) and metal complexes (mostly cobalt). The formation of fluoro complexes is rather limited and none have been isolated in crystalline form.

The effect of temperature on structure has been investigated,[38,92,93,102,103] a decrease in Zn-X bond distance being associated with decreasing temperature. Some mean values for room temperature and lower temperatures are: 2.2499Å[38a] *vs* 226.0Å at 250K[38b] (X = Cl); 2.393Å[92] *vs* 2.404Å at 193K[93] (X = Br); and 2.618Å[102] *vs* 2.621Å at 150K[103] (X = I).

Some tetrahedrally-coordinated zinc(II) compounds are found in two isomeric forms in which the Zn-L distances and L-Zn-L angles differ by degree of distortion.[51,59,97,138,139,176,177,185,186] In several cases two crystallographically independent molecules, differing by degree of distortion, have been found in one crystal.[39,68,71,105,131,207,218] This type of distortion isomerism has been observed in other metal complexes, particularly in copper(II) chemistry.[220]

Four-coordinate zinc(II) complexes are usually colourless, but colour is observed where ligand absorptions or charge transfer bands occur in the visible range.

3.2 *Coordination Number Five*

Crystallographic and structural data for five-coordinate zinc compounds are found in Table 2. Two types of geometry are observed; square pyramidal and the more common trigonal bipyramidal. There are 24 examples of the first geometry (Table 2a). In colourless $Zn(C_{10}H_9O_2)_2(EtOH)$[221] the Zn atom is 0.32Å above the plane of the two identical, chelating oxygen atoms. The apical position is occupied by the ethanol molecule, and this is the only example in which all five donor atoms are oxygen. The most common arrangement is a basal plane of four nitrogen atoms of a tetradentate macrocycle, with the apical position occupied by pyridine or chlorine.

Table 2 Crystallographic and structural data for five-coordinated zinc(II) compounds[a].

A: SQUARE — PYRAMIDAL									
COMPOUND (Colour)	Crys. cl Sp. Gr Z	a[Å] b[Å] c[Å]	α[°] β[°] γ[°]	Chromo-phore Zn-out of plane [Å]		Zn-L [Å]		L-Zn-L [°]	Ref. [°]
$Zn(C_{10}H_9O_2)_2(EtOH)$	m	12.28(1)		ZnO_5	Oeq[b]	1.99	Oeq,Oeq[b]	88.4(3,1.7)[c]	221
(colourless)	$P2_1c$	8.39(1)	100.58(1)	0.32	EtHOap	2.06		161.3(3,4.3)	
	4	20.52(2)					Oeq,Oap	99.3(3,5.2)	
Zn(oep)(py)	tr	10.486(2)	93.99(2)	ZnN_5	Neq	2.066(3,9)	Neq,Neq,	88.1(1,2)[c]	222
(red)	$P\bar{1}$	17.192(4)	93.81(2)	0.31	pyNap	2.200(3)		163.0(1,1.2)	
	2	10.048(2)	83.84(2)				Neq,Nap	99.0(1,2.4)	
$[Zn(tpibc)(py)]\cdot C_6H_6$	tr	11.452(5)	99.05(2)	ZnN_5	Neq	2.086(3,30)	Neq,Neq	88.6(1,5)[c]	223
(purple)	$P\bar{1}$	13.332(4)	94.37(4)	0.33	pyNap	2.155(3)		162.1(1,6)	
	2	14.718(6)	104.88(4)				Neq,Nap	99.0(1,5.0)	
$[Zn(tpc)(py)]\cdot C_6H_6$	tr	11.414(2)	99.18(1)	ZnN_5	Neq	2.081	Neq,Neq	92.0(1,12.0)[c]	224
(purple)	$P\bar{1}$	13.334(2)	94.14(1)	0.33	pyNap	2.171(2)		161.6(1,6)	
	2	14.809(1)	105.08(1)				Neq,Nap	95.4(1,6.6)	
Zn(tpyp)(py)	m	14.748(2)		ZnN_5	Neq	2.073(3,6)	Neq,Neq	88.5(1,3)[c]	225
(purple)	$C2/c$	18.136(3)	100.66	0.33	pyNap	2.143(2)	Neq,Nap	not given	
	4	13.622(2)							
$[Zn(tcpp)(py)]\cdot py$	m	18.805(2)		ZnN_5	Neq	2.076(12,0)		not given	226
(purple)	Cc	16.647(4)	115.49(2)	0.37	pyNap	2.151(4)			
	4	16.724(2)							
$[Zn(trppe)]\cdot(C_6H_6)$	m	13.970(4)		ZnN_5	Neq	2.059(7,15)	Neq,Neq	88.5(3,4)[c]	227
$(EtOH)_{0.5}$	$P2_1/c$	15.184(6)	121.54(2)	0.37	Nap	2.147(7)	Neq,Nap	99.2(3,5.4)	
(purple)	4	26.110(2)							
Zn(tpibc)(py)	tr	11.489(1)	98.92(1)	ZnN_5	Neq	2.083(4,40)	Neq,Neq	88.7(1)[c]	228
(purple)	$P\bar{1}$	13.248(2)	94.43(1)	0.38	pyNap	2.164(5)	Neq,Nap	not given	
	2	14.788(2)	105.04(1)						
Zn(pc)(ham)	m	12.40(2)		ZnN_5	Neq	2.06(2,3)	Neq,Neq	86(2,2)[c]	229
(purple)	$P2_1/c$	15.76(2)	93.2(5)	0.48	Nap	2.18(2)	Neq,Nap	not given	
	4	20.05(5)							
$Zn(tpp)(ClO_4)$	m	13.638(4)		ZnN_4O	Neq	2.076(9,18)	N,N	88.4(3,6)[c]	230
(not given)	$P2_1/c$	13.017(5)	107.63(2)	0.347	O_3ClOap	2.079(8)	N,O	99.6(4,2.1)	
	4	20.458(8)							
$Zn(hp)(H_2O)$	or	8.824(14)		ZnN_4O	Neq	2.034(8,76)		not given	231[a]
(not given)	$Pcab$	19.376(3)		not given	H_2Oap	1.969(6)			
	8	23.678(5)							

Table 2 *Continued*

A: SQUARE — PYRAMIDAL									
COMPOUND (Colour)	Crys.cl Sp. Gr Z	a[Å] b[Å] c[Å]	α[°] β[°] γ[°]	Chromo-phore Zn-out of plane [Å]		Zn-L [Å]		L-Zn-L [°]	Ref. [°]
$Zn(oefb)(H_2O)$	m	11.019(7)		ZnN_4O	N_{eq}	2.04(2)			231[b]
(brown)	$P2_1/c$	39.378(30)	95.39(6)	not given	H_2O_{ap}	2.10(2)	not given		
	4	7.751(2)							
Zn(tptbp)(thf)	trg	34.15(5)		ZnN_4O	Neq	2.077(17,0)	N,N	89.5(7)[c]	232
(blue)	$R\bar{3}$	—		not given	thfOap	2.211(13)	N,O	96.6(6)	
	18	23.44(5)							
$[Zn(tdcpp)(mp)]\cdot(mp)_3$	tr	11.470(9)	84.25(4)	ZnN_4O	Neq	2.063(4,15)	N,N	88.7(1,5)[c]	27
(purple)	$P\bar{1}$	13.155(7)	79.00(5)	not given	mpOap	2.089(5)	N,O	98.7(3,3.3)	
	2	19.894(10)	75.59(6)						
Zn(opd)Cl	tr	12.967(4)	108.95(9)	ZnN_4Cl	Neq	2.062(12,46)	N,N	86.1(5,4.3)[c]	233
(violet)	$P\bar{1}$	15.232(19)	92.31(8)	0.54	Clap	2.279(6)	N,Cl	105.7(4,1.8)	
	2	9.223(8)	73.77(9)						
$[Zn(tmt)Cl]\cdot ClO_4$	m	8.230(2)		ZnN_4Cl	Neq	2.197(11,14)	N,N	82.9(1,1.1)[d]	234
(not given)	$P2_1$	15.156(3)	108.64(2)	0.57	Clap	2.265(4)		90.3(4,0)[c]	
	2	8.569(2)					N,Cl	104.1(3,2.6)	
Zn(bztpp)Cl	tr	10.579(2)	85.31(1)	ZnN_4Cl	Neq	2.065(3,42)	N,N	84.9(1,4.1)[c]	235
(violet)	$P\bar{1}$	12.310(2)	80.89(1)	0.58	Neq	2.477(3)	N,Cl	100.3(1,17.1)	
	2	17.957(3)	72.63(1)		Clap	2.265(1)			
Zn(pc)Cl	tg	13.85(1)		ZnN_4Cl	Neq	2.034		not given	236
(not given)	$P4/nnc$	—		0.586	Clap	2.35			
	4	13.09(1)							
Zn(metpp)Cl	tr	11.970(6)	101.73(1)	ZnN_4Cl	Neq	2.063(9.45)	N,N	84.5(3,5.2)[c]	237
(purple)	$P\bar{1}$	13.468(8)	107.00(2)	0.65	Neq	2.530(7)	N,Cl	107.1(2,13.7)	
	2	14.998(7)	115.88(2)		Clap	2.232(3)			
Zn(phtpp)Cl	or	15.078(5)		ZnN_4Cl	Neq	2.071(6,51)	N,N	84.3(2,4.7)[e]	235
(purple)	$P2_12_12_1$	15.272(5)		0.67	Neq	2.492(6)	N,Cl	107.7(2,10.7)	238
	4	17.268(5)			Clap	2.227(2)			
[Zn(dhtcp)I]I	m	8.279(3)		ZnN_4I	Neq	2.112(5,23)	N,N	76.3(2)[d]	239
(not given)	$P2_1/c$	18.211(6)	99.21(4)	0.41	Iap	2.662(1)		94.5(2,5.4)	
	4	14.723(4)					N,I	101.6(2,6.6)	
[Zn(trien)I]I	or	11.97(1)		ZnN_4I	Neq	2.16(1,3)	N,N	82.3(4,3.5)[d]	240
(colourless)	$P2_12_12_1$	13.72(1)		0.71	Iap	2.58(1)	N,I	109.1(4,5.1)	
	4	8.12(1)							

Table 2 *Continued*

COMPOUND (colour)	Crys.cl Sp. Gr Z	a[Å] b[Å] c[Å]	α[°] β[°] γ[°]	Chromo-phore Zn-out of plane [Å]		Zn-L [Å]	L-Zn-L [Å]		Ref. [°]
A: SQUARE — PYRAMIDAL									
$(NBu_4)[Zn(Me_2NCS_2)_2 \cdot (C_7H_4NS_2)] \cdot EtOH$	*m*	16.797(3)		ZnS_4N	Seq	2.502(4,126)	S,S	71.4(1,2)[e]	81
(yellow)	$P2_1/n$	15.349(7)	111.74(9)	not given	Nap	2.061(8)		96.5(1,5.3)	
	4	16.677(10)					S,N	108.8(2,5.3)	
$[Zn(C_{16}H_{13}N_3O_2S) \cdot (py)]$	*tr*	12.932(4)	97.28(9)	ZnN_3O_2	Oeq	1.965(7,2)	O,O	99.1(3)	241
(not given)	$P\bar{1}$	10.968(4)	77.55(9)	0.427	Neq	2.104(8,2)	Neq,Neq	74.4(3)[d]	
	2	8.072(3)	74.02(6)		pyNap	2.098(8)	O,Neq	88.1(3,5)	
							O,Nap	102.6(3,2.3)	
							Neq,Nap	101.6(3,5)	
$Zn(C_{25}H_{25}N_3S_2)I_2$	*tr*	19.523(11)	79.6(1)	ZnN_3I_2	Neq	2.198(17,95)	N,N	72.8(6,9)[d]	242
(not given)	$P\bar{1}$	8.491(7)	115.6(1)	0.55	Ieq	2.540(4)		139.9(6)	
	4	18.792(11)	96.4(1)		Iap	2.682(4)	N,I	100.2(6,5.3)	
							I,I	111.4(1)	
				ZnN_3I_2	Neq	2.217(19,116)	N,N	71.8(6,4)[d]	
				0.58	Ieq	2.558(4)		137.7(6)	
				0.58	Iap	2.620(3)	N,I	100.76(6,4.0)	
							I,I	111.7(1)	
B: TRIGONAL — BIPYRAMIDAL									
$Zn(H_2O)_3(bzgly)_2$	*tr*	5.157(2)	83.60(4)	ZnO_5	Oeq	1.978(4,7)	Oeq,Oeq	120.0(2,14.3)	243
(colourless)	*P*1	5.192(2)	86.19(4)		H_2Oeq	2.007(4)	Oeq,Oap	90.1(2,1.8)	
	1	20.092(9)	83.42(3)		H_2Oap	2.165(5,7)	Oap,Oap	177.1(2)	
$Zn(C_5H_7O_2)_2(H_2O)$	*m*	10.91(1)		ZnO_5	Oeq	1.96(3,4)	Oeq,Oeq	120(2,28)	244
(colourless)	$P2_1$	5.517(5)	93.6(2)		H_2Oeq	2.02(3)	Oeq,Oap	85(2,3)[c]	
	2	10.46(1)			Oap	2.11(3.2)		95(2,6)	
							Oap,Oap	162(2)	
[Zn(tren)(NCS)·(NCS)	*or*	12.888(2)		ZnN_5	Neq	2.058(6,14)	Neq,Neq	117.5(2,1,5)	245
(colourless)	Pbca	16.466(3)			Nap	2.292(4)	Nep,Nap	80.8(2,9)[d]	
	8	13.633(2)			SCNap	2.043(5)		99.2(2,2.6)	
							Nap,Nap	176.77(1)	
$Zn(C_{18}H_{19}N_5O)(NCS)_2$	*m*	15.421(4)		ZnN_5	Neq	2.049(9,14)	Neq,Neq	115.9(3,2.8)	246
(colourless)	$P2_1/a$	14.803(4)	115.81(2)		SCNeq	1.951(10)	Neq,Nap	72.1(3,9)[d]	
	4	10.589(3)			Nap	2.652(8)		99.2(4,7.9)	
					SCNap	2.045(9)	Nap,Nap	162.4(3)	

Table 2 *Continued*

B: TRIGONAL — BIPYRAMIDAL									
COMPOUND (colour)	Crys.cl Sp. Gr Z	a[Å] b[Å] c[Å]	α[°] β[°] γ[°]	Chromo-phore Zn-out of plane [Å]	Zn-L [Å]		L-Zn-L [Å]		Ref. [°]
$[Zn(dien)(bipyam)]\cdot(NO_3)_2$	m	12.34(5)		ZnN_5	(d)Neq	2.088(9,9)	Neq,Neq	119.8(4,8.0)	247
(colourless)	$P2_1/c$	16.26(5)	92.0(5)		(b)Neq	2.082(9)	Neq,Nap	81.3(4,4)[d]	
	4	9.92(5)			(d)Nap	2.252(9)		88.9(4)[c]	
					(b)Nap	2.148(9)		94.3(4,5.3)	
							Nap,Nap	168.3(2)	
$[Zn(dmpd)_3]\cdot Cl_2\cdot H_2O$	tr	9.021(2)	59.01(2)	ZnN_5	Neq	2.073(6,27)	Neq,Nap	120.0(2,17.6)	26
(white)	$P\bar{1}$	12.087(2)	70.35(2)		Nap	2.206(5,27)	Neq,Nap	85.3(2,6)[d]	
	2	13.785(3)	76.01(2)					92.9(2,3.9)	
							Nap,Nap	172.1(2)	
$[Zn(C_{17}H_{31}H_5)]\cdot(ClO_4)_2$	m	9.935(3)		ZnN_5	Neq	2.051(5,60)	Neq,Neq	88.2(2)[c]	248
(white)	$P2_1/n$	15.603(4)	94.30(2)		Nap	2.246(5,6)		135.9(2,1.6)	
	4	15.203(3)					Neq,Nap	80.8(2,3.0)[d]	
								114.2(2)	
							Nap,Nap	155.9(2)	
$[Zn(C_{33}H_{39}N_5)]\cdot(ClO_4)_2$[f]	m	11.517(2)		ZnN_5	Neq	2.049(7,37)	Neq,Neq	84.0(2)[d]	249
(colourless)	$P2_1/n$	25.970(5)	91.00(1)		Nap	2.280(7,19)		138.0(2,4.5)	
	8	24.445(5)					Neq,Nap	77.8(2,1)[d]	
								99.05(5.2)	
							Nap,Nap	155.2(2)	
				ZnN_5	Neq	2.027(6,26)	Neq,Neq	84.7(2)[d]	
					Nap	2.314(6,16)		137.6(3,5)	
							Neq,Nap	78.0(2,1)[d]	
								98.8(2,4.6)	
							Nap,Nap	155.7(2)	
$[Zn(pmpn)_2(lac)](lacH)\cdot$	m	8.818(3)		ZnN_4O	Neq	2.050(8,46)	Neq,Neq	141.9(3)	250
H_2O	$P2_1$	18.887(5)	102.13(2)		Oeq	2.009(5)	Neq,O	109.0(3,1.9)	
(colourless)	2	8.500(2)			Nap	2.249(8,15)	Nap,Nap	80.5(3,1.3)[d]	
								94.3(3,1)	
							O,Nap	97.9(3,1.7)	
							Nap,Nap	164.3(3)	

Table 2 *Continued*

B: TRIGONAL — BIPYRAMIDAL

COMPOUND (colour)	Crys. cl Sp. Gr Z	a[Å] b[Å] c[Å]	α[°] β[°] γ[°]	Chromo-phore Zn-out of plane [Å]	Zn-L [Å]		L-Zn-L [Å]		Ref. [°]
$[Zn(NH_3)_3(orotato)]\cdot H_2O$	*tr*	7.052(4)	114.34(5)	ZnN_4O	H_3Neq	2.026(4,16)	Neq,Neq	116.3(2)	251
(colourless)	$P\bar{1}$	8.722(5)	104.63(5)		Neq	2.060(4)	Neq,Oap	77.0(1)[d]	
	2	7.616(6)	92.43(5)		Oap	2.213(3)	Neq,Nap	97.5(2,1.2)	
					H_3Nap	2.121(4)			
$[Zn(C_{11}H_{26}N_4)(ClO_4)]\cdot ClO_4^-$	*m*	10.412(6)		ZnN_4O	Neq	2.009(9,22)		not given	252[a]
(colourless)	$P2_1/c$	23.364(11)	92.08(4)		Nap	2.106(7)			
	8	12.461(6)			O_3ClOap	2.818(5)			
				ZnN_4O	Neq	2.015(7,11)			
					Nap	2.079(7)			
					O_3ClOap	2.528(5)			
$[Zn(Me_4[14]aneN_4)(ae)]\cdot ClO_4$	*tr*	11.462(1)	109.04(1)	ZnN_4O	Neq	2.137(3,7)	Neq,Neq	138.0(1)	252[b]
(colourless)	$P\bar{1}$	12.324(2)	98.51(2)		Oeq	1.965(3)	Neq,Oeq	110.9(1,10.8)	
	2	8.369(1)	87.52(1)		Nap	2.229(3,7)	Neq,Nap	83.7(1,2)[d]	
								91.5(1,1.1)	
							Oeq,Nap	96.9(1,4.9)	
							Nap,Nap	166.2(1)	
$Zn(C_{15}H_{32}N_4)(ClO_4)$	*or*	13.875(13)		ZnN_4O	Neq	2.04	N,N	87.8[d]	34
(not given)	$Pn2_1a$	9.811(6)			Nap	2.04		105.6	
	4	16.186(9)			O_3ClOap	2.71		123.1	
$[Zn(tren)Cl]\cdot(BPh_4)$	*m*	13.76(4)		ZnN_4Cl	Neo	2.065(7,3)	Neq,Neq	116.5(3,3.2)	253
(colourless)	$P2_1/c$	10.33(3)	95.0(2)		Nap	2.325(7)	Neq,Nap	79.1(3,5)[d]	
	4	20.35(6)			Clap	2.308(5)	Neq,Cl	100.9(3,3.2)	
							Nap,Cl	176.4(2)	
$[Zn(Me_6tren)Br]\cdot Br$	*c*	12.105(3)		ZnN_4Br	Neq	2.11(2,0)	Neq,Neq	117.4(9)	254
(not given)	$P2_13$				Nap	2.19(2)	Neq,Nap	80.7(1,0)[d]	
	4				Brap	2.449(3)	Neq,Br	99.3(6)	
$Zn\{(PrO)_2PS_2\}_2(py)$	*m*	21.28(1)		ZnS_4N	Seq	2.314(4,45)	Seq,Seq	128.9(2)	182
(not given)	$P2_1/n$	8.35(1)	99.5(1)		pyNeq	2.015(12)	Seq,N	113.5(3,4.4)	
	4	16.27(1)			Sap	2.767(4,265)	Seq,Sap	80.3(1,4.5)[e]	
							Sap,N	94.7(3,6.1)	
							Sap,Sap	169.29(13)	

Table 2 *Continued*

B: TRIGONAL — BIPYRAMIDAL									
COMPOUND (colour)	Crys.cl Sp. Gr Z	a[Å] b[Å] c[Å]	α[°] β[°] γ[°]	Chromo-phore Zn-out of plane [Å]		Zn-L [Å]		L-Zn-L [Å]	Ref. [°]
$Zn(Me_2dtc)_2(py)$ (colourless)	m $P2_1/c$ 4	12.67(10) 7.966(5) 20.13(20)	105.27(6)	SnS_4N	Seq pyNeq Sap	2.328(4,3) 2.079(6) 2.605(4,7)	Seq,Seq Seq,N Seq,Sap Sap,N Sap,Sap	127.1(3) 116.5(3,4) 73.2(4,3)[e] 102.4(4,3) 94.9(4,1.0) 170.2(4)	255
$[Zn(C_6H_6N_4)(HCO_2)]\cdot ClO_4$ (yellow)	m $P2_1/c$ 4	8.846(5) 26.921(16) 7.174(5)	90.35(6)	ZnN_4O	Neq Oeq Nap	2.053(4,10) 2.006(3) 2.203(4,29)	Neg,Neq Neq,O Neq,Nap O,Nap Nap,Nap	128.5(2) 115.7(2,12.1) 79.3(2,7)[d] 94.0(2.5) 97.5(2,5.0) 164.7(2)	252[g]
$Zn(EtOCS_2)_2(py)$ (colourless)	m $A2/a$ 4	14.001(5) 8.911(2) 13.731(6)	104.80(3)	ZnS_4N	Seq pyNeq Sap	2.294(3,0) 2.03(1) 2.748(3,0)	Seq,Seq Seq,N Seq,Sap Sap,N Sap,Sap	129.2(1) 115.4(1) 71.4(1)[e] 96.5(1) 103.8(1) 152.3(1)	256
$Zn(H_2NC(S)CO_2)_2(H_2O)$ (colourless)	m $C2/c$ 8	11.824(3) 8.330(2) 19.761(4)	104.48(2)	ZnO_3S_2	H_2Oeq Oeq Seq Oap Sap	1.994(2) 2.067(2) 2.366(1) 2.101(2) 2.415(1)	Oeq,Oeq Oeq,Seq Oeq,Oap Oeq,Sap Seq,Oap Oap,Sap	117.5(1) 120.4(1,6.1) 86.2(1,3.0) 84.1(1)[d] 98.4(1) 84.6(1)[d] 167.1(1)	257
$[Zn(H_2NC(O)COS)_2(H_2O)]\cdot H_2O$ (colourless)	tr $P\bar{1}$ 2	7.558(6) 7.109(4) 11.309(9)	65.05(5) 65.30(5) 87.06(5)	ZnO_3S_2	H_2Oeq Seq Oap	2.035(6) 2.321(2,6) 2.213(5,101)	Oeq,Seq Seq,Seq Oeq,Oap Seq,Oap Oap,Oap	110.3(1,4.0) 139.4(2) 91.8(1,4) 85.2(1,3)[d] 93.6(1,1.2) 176.3(2)	257

Table 2 *Continued*

B: TRIGONAL – BIPYRAMIDAL									
COMPOUND (colour)	Crys. cl Sp. Gr *Z*	*a*[Å] *b*[Å] c[Å]	α[°] β[°] γ[°]	Chromo-phore Zn-out of plane [Å]	Zn-L [Å]		L-Zn-L [Å]		Ref. [°]
$[Zn(C_{11}H_{16}N_3O)(H_2O)]\cdot Br$	*m*	9.129(1)		ZnN_3O_2	Neq	2.059(4,24)	Neq,Neq	82.4(1)[d]	258
(yellow)	$P2_1/c$	14.207(1)	102.36(1)		H_2Oeq	2.039(3)	Neq,Oeq	105.5(1,4.5)	
	4	11.003(1)			Nap	2.171(3)	Neq,Oap	93.2(1,3.2)	
					Oap	2.000(2)	Oeq,Nap	100.4(1)	
							Neq,Nap	147.191)	
							Oap,Nap	160.4(1)	
$[Zn(C_{15}H_{24}N_3O)(H_2O)]\cdot$	*m*	16.673(2)		ZnN_3O_2	Neq	2.040(5,11)	Neq,Neq	108.3(2)	259
ClO_4	$P2_1/a$	13.952(2)	91.73(1)		Oeq	1.930(4)	Neq,Oeq	125.9(2,12.9)	
(colourless)	4	8.286(1)			Nap	2.139(5)	Neq,Nap	88.9(2,1.5)[c]	
					H_2Oap	2.219(4)	Nap.Oap	174.4(2)	
$Zn(C_{13}H_{13}N_2O)_2(MeCN)$	*or*	14.398(4)		ZnN_3O_2	Oeq	1.938(2,0)	O,O	134.0(1)	260
(colourless)	Pbcn	8.190(2)			MeCNeq	2.114(4)	O,Neq	112.99(6,0)	
	4	22.298(4)			Nap	2.170(2,1)	O,Nap	81.8(1)[d]	
								96.7(1)	
							Neq,Nap	91.9(1)	
							Nap,Nap	176.2(1)	
$[Zn(cbp)]\cdot H_2O$	*tr*	10.099(1)	74.57(3)	ZnN_3O_2	Neq	2.160(6)	Neq,Oeq	114.8(2,3.3)	261
(not given)	$P\bar{1}$	12.500(2)	68.06(1)		Oeq	1.956(5,9)	Oeq,Oeq	130.4(2)	
	2	13.261(4)	86.07(2)		Nap	2.160(6)	Neq,Nap	90.0(2,4)[c]	
							Oeq,Nap	87.8(2)[c]	
								92.2(2,1.9)	
							Nap,Nap	177.9(2)	
$[Zn(mbp)]\cdot H_2O$	*m*	16.30(1)		ZnN_3O_2	Neq	2.187(8)	Neq,Oeq	117.8(3,4.4)	261
(not given)	$P2_1/c$	10.178(4)	71.79(9)		Oeq	1.953(5,4)	Oeq,Oeq	124.3(3)	
	4	18.996(9)			Nap	2.117(6,3)	Neq,Nap	87.3(3,3)[c]	
							Oeq,Nap	89.2(2,9)[c]	
								93.5(2,4.2)	
							Nap,Nap	172.5(3)	
$[Zn(C_{21}H_{19}N_3)Cl_2]\cdot$	*tr*	8.977(3)	90.99(3)	ZnN_3Cl_2	Neq	2.095(7)	Neq,Cl	120.5(2,2.7)	262
1.5 MeCN	$P\bar{1}$	12.585(5)	98.27(2)		Cleq	2.237(3,15)	Cl,Cl	119.0(2)	
(not given)	4	22.297(6)	94.33(3)		Nap	2,238(7,12)	Neq,Nap	74.1(3,4)[d]	
							Nap,Nap	148.0(3)	

Table 2 *Continued*

B: TRIGONAL – BIPYRAMIDAL									
COMPOUND (colour)	Crys. cl Sp. Gr Z	a[Å] b[Å] c[Å]	α[°] β[°] γ[°]	Chromo-phore Zn-out of plane [Å]		Zn-L [Å]		L-Zn-L [Å]	Ref. [°]
				ZnN_3Cl_2	Neq	2.081(7)	Neq,Cl	120.5(2,4.4)	
					Cleq	2.242(3,4)	Cl,Cl	119.1(1)	
					Nap	2.267(8,16)	Neq,Nap	73.6(3,4)[d]	
							Nap,Nap	147.1(3)	
$Zn(terpy)Cl_2$	m	16.21		ZnN_3Cl_2	Neq	2.09(4)	Neq,Cl	124(–,19)	263
(not given)	$P2_1/a$	8.25	93.5		Cleq	2.26(1,1)	Cl,Cl	112	
	4	10.97			Nap	2.21(4,3)	Neq,Nap	74(–,1)[c]	
							Nap,Nap	145	
$Zn(terpy)Cl_2$	m	17.07(1)		ZnN_3Cl_2	Neq	2.112(1)	Neq,Cl	121.46(5)	264
(not given)	$C2/c$	9.106(8)	125.57(9)		Cleq	2.274(1,0)	Cl,Cl	117.08(4)	
	4	11.41(1)			Nap	2.196(3,0)	Neq,Nap	74.54(9)[c]	
							Nap,Nap	149.09(13)	
$[Zn(C_9H_{11}N_3O_2)Cl_2]\cdot H_2O$	m	10.140(3)		ZnN_3Cl_2	Neq	2.063(2)	Neq,Cl	119.3(7.2.7)	265
(white)	$P2_1/n$	14.505(4)	103.90(2)		Cleq	2.238(1,6)	Cl,Cl	121.17(3)	
	4	9.768(2)			Nap	2.242(2,4)	Neq,Nap	73.6(9,4.8)[c]	
							Cl,Nap	97.1(1,1.2)	
$Zn(C_{21}H_{17}N_3S_2)$	m	9.268(8)		ZnN_3S_2	Neq	2.117(6)	Neq,S	124.8(2,7)	266
(red)	$P2_1$	13.174(13)	105.00(4)		Seq	2.335(2,4)	S,S	110.4(1)	
	2	8.172(7)			Nap	2.191(7,21)	Neq,Nap	72.8(2,4)[d]	
							S,Nap	80.4(2,7)[d]	
								120.3(2,2)	
							Nap,Nap	145.6(3)	
$Zn(C_{10}H_{15}N_3)Br_2$	tr	10.730(2)	120.69(2)	ZnN_3Br_2	Neq	2.087(6)	Neq,Br	122.8(2,2.4)	267
(white)	$P\bar{1}$	11.248(2)	91.36(2)		Breq	2.403(1,7)	Br,Br	114.2(1)	
	2	7.433(2)	110.70(1)		Nap	2.240(8,6)	Neq,Nap	75.9(3,5)[d]	
							Br,Nap	97.9(2,3.3)	
							Nap,Nap	150.2(2)	
$Zn(C_6H_{14}O_3N)Cl$	tr	8.09(4)	101.8(3)	ZnO_3NCl	Oeq	2.09(2,8)	O,O	117.7(6,6.7)	268
(not given)	$P\bar{1}$	8.39(3)	105.6(3)		Nap	2.15(2)	O,N	81.4(5,3.1)[d]	
	2	7.53(2)	90.0		Clap	2.26(1)	O,Cl	98.9(5,6.9)	
							N,Cl	169.7(7)	

Table 2 *Continued*

B: TRIGONAL — BIPYRAMIDAL									
COMPOUND (colour)	Crys. cl Sp. Gr *Z*	*a*[Å] *b*[Å] c[Å]	α[°] β[°] γ[°]	Chromo-phore Zn-out of plane [Å]	Zn-L [Å]		L-Zn-L [Å]		Ref. [°]
$Zn(bpy)(C_{18}H_9NOS)$[f] (yellow)	*tr* *P*1 2	6.526(2) 11.686(3) 13.346(4)	107.72(2) 92.08(2) 91.79(2)	ZnN_3OS	bNeq Oeq Seq Nap bNap	2.13(1) 1.950(8) 2.327(4) 2.097(8) 2.15(1)	Neq,O Neq,S O,S Nap,Nap	105.8(4) 111.6(3) 142.4(3) 175.1(3)	269
				ZnN_3OS	bNeq Oeq Seq Nap bNap	2.13(1) 1.939(5) 2.340(4) 2.100(9) 2.150(9)	Neq,O Neq,S O,S Nap,Nap	105.0(4) 111.1(3) 143.7(4) 176.3(3)	
$Zn(C_{19}H_{14}N_3S_2)(MeCO_2)$ (not given)	*m* $P2_1/c$ 4	12.266(4) 9.457(2) 19.783(5)	118.48(1)	ZnN_3OS	Neq Oeq Nap Sap	2.153(6,55) 1.946(6) 2.287(6) 2.272(6)		not given	270
$Zn(C_{18}H_{13}BrN_4O)Cl_2$ (yellow)	*m* $P2_1/c$ 4	8.039(1) 19.448(2) 13.300(3)	115.55(2)	ZnN_2Cl_2O	Neq Cleq Oap Nap	2.149(7) 2.239(3,8) 2.229(7) 2.147(10)	Neq,Cl Cl,Cl Neq,O Neq,Nap Cl,O Cl,Nap O,Nap	123.6(2,9.8) 112.6(1) 71.4(2)[d] 72.4(3)[d] 98.4(2,6) 101.7(2,1.9) 143.4(3)	271
$[Zn(atuH)_2(H_2O)]\cdot 2H_2O$ (white)	*m* *C*2/*c* 4	9.391(2) 10.497(2) 15.360(1)	101.02(1)	ZnN_2S_2O	H_2Oeq Seq Nap	1.968(4) 2.353(1,0) 2.235(2,0)	O,S S,S O,N S,N N,N	116.78(3) 126.4(1) 94.50(9) 69.16(7)[e] 106.6(1) 171.0(1)	272
$Zn(C_{11}H_{17}NS_2)Br_2$ (colourless)	*m* $P2_1/n$ 4	12.622(7) 9.226(3) 15.033(4)	107.85(3)	ZnS_2Br_2N	Neq Breq Sap	2.083(5) 2.371(1,35) 2.686(2,54)	N,Br Br,Br N,S Br,S S,S	117.3(1,3) 125.3(1) 78.5(2,6)[d] 95.2(1,5.2) 157.0(1)	273

Table 2 *Continued*

COMPOUND (colour)	Crys.cl Sp. Gr Z	a[Å] b[Å] c[Å]	α[°] β[°] γ[°]	Chromo-phore Zn-out of plane [Å]		Zn-L [Å]		L-Zn-L [Å]	Ref. [°]
C: SQUARE-PYRAMIDAL ↔ TRIGONAL – BIPYRAMIDAL									
$Zn(acac)_2(H_2O)$	*m*	10.48		ZnO_5	O	2.020(2,18)	O,O	88.3(8,3)[c]	274
(colourless)	$P2_1$	5.37	93.48		H_2O	1.999(2)		104.4(8,6.9)	
	2	10.94							
$[Zn(C_{19}H_{23}N_7)]\cdot(ClO_4)_2$	*m*	19.414(8)		ZnN_5	N	1.990(5,2)	N,N	75.5(2,1)[d]	275
(yellow)	*C2/c*	11.313(4)	108.50(3)			2.067(5)		120.0(2,9.8)	
	8	24.012(6)				2.176(5,5)		150.8(2)	
$[Zn(C_{23}H_{27}N_7)]\cdot(ClO_4)_2$	*or*	28.872(18)		ZnN_5	N	1.998(3,2)	N,N	115.5(1)	276
(not given)	$P2_12_12_1$	9.567(6)				2.032(2)		122.4(1,1.3)	
	4	10.344(6)				2.195(3,1)		151.1	
$[Zn(6\text{-}H_2Nqu)_2(H_2O)]\cdot$	*m*	11.234(1)		ZnN_4O	N	2.11(1,1)	N,N	79.8(2)[d]	48
$[ZnCl_4]$	*C2/c*	10.8527(8)	108.43(1)		O	2.011(7)		96.1(2)	
(colourless)	4	19.025(2)					N,O	104.0(1,8.7)	
				$ZnCl_4$	Cl	2.273(5,2)	Cl,Cl	109.5(6,3,2)	
$Zn(C_{12}H_{10}N_4)_2Cl_2$	*m*			ZnN_3Cl_2	N	2.17(2,1)	N,N	71.4(8,4)[d]	277
(orange)	$P2_1/n$	14.582(16)	90.50		Cl	2.279(5,22)		87.3(8,8)	
	4	10.822(9)						156.5(8)	
							N,Cl	109.9(7,27.1)	
							Cl,Cl	112.2(2)	
$Zn(C_8H_{14}N_6OS_2)(H_2O)$	*tr*	8.769(7)	100.87(5)	ZnN_2S_2O	N	2.137(4,12)	N,N	74.3(2)[d]	278
(yellow)	$P\bar{1}$	9.388(7)	94.47(5)		S	2.359(1,2)	S,S	118.1(2)	
	2	8.866(7)	83.22(5)		H_2O	2.091(4)	N,S	80.1(2,6)	
							N,O	97.5(2,3.8)	
							S,O	102.4(2,2.4)	

[a] Where more than one chemically equivalent distance or angle is present, the mean value is tabulated. The first number in parenthesis is e.s.d., the second is a maximum deviation from the mean value. [b] The chemical identity of coordinated atom (ligand) is specified in these columns. [c] Six-membered metallocyclic ring. [d] Five-membered metallocyclic ring. [e] Four-membered metallocyclic ring. [f] There are two crystallograpically independent molecules.

The displacement of the Zn(II) atom from the basal plane towards the apical position ranges from 0.31 to 0.71Å. The mean Zn-L apical bond distance increases with the covalent radius of the ligand atom in the sequence: 2.082Å (LO) < 2.158Å (LN) < 2.314Å (Cl) < 2.637Å (I). The L_{eq}-Zn-L_{eq} angles are in the range 72° to 92° and 138° to 163°, indicating a considerable deviation from the ideal values of 86.6° and 151.9°. The L_{eq}-Zn-L_{ap} angle ranges from 83° to 127° compared to the ideal square pyramidal angle of 104.1°.

There are thirty-six examples in which the coordination geometry of the Zn(II) atom is a distorted trigonal bipyramid (Table 2b). The mean Zn-L_{eq} bond distance is shorter than that of Zn-L_{ap}, for example: 2.01 *vs* 2.30Å (LO); 2.02 *vs* 2.08Å (NL); 2.25 *vs* 2.28Å (Cl); 2.10 *vs* 2.16Å (bidentate LN); 2.08 *vs* 2.235Å (tridentate NL); 2.05 *vs* 2.17Å (tetradentate NL); and 2.04 *vs* 2.28Å (pentadentate NL). The angles for an idealized trigonal bipyramid are 120°, 90° and 180°. By contrast, the observed angles range from 82° to 142° (L_{eq}-ZnL_{eq}), 70° to 147° (L_{eq}-Zn-L_{ap}) and 143° to 178° (L_{ap}-Zn-L_{ap}), respectively. Chelate ligands spanning the apical and equatorial positions are primarily responsible for these distortions.

The remaining six examples (Table 2c) have a zinc(II) environment intermediate between trigonal bipyramidal and square planar. The overall data in Table 2 show the use of mono-, bi-, tri- and tetra-dentate ligands. The chelating ligands show variations in the L-Zn-L angle of the metallocyclic ring dependent on the ring size. For the four-membered rings, the intraligand angle at zinc ranges from 71° to 80° for S-donors and 69° for N + S-donors. For the five-membered rings, the angle variations are 72° to 83° (unsaturated N-donor) and from 82° to 88° (saturated N-donor). For the six-membered rings the L-Zn-L angles are all within the range 82° to 94°. In general, the mean value of the Zn-L bond distance increases as the covalent radius of the donor atom increases, and the values for the five-coordinate species are somewhat longer than those of the four-coordinate derivatives, as expected.

Two crystallographically independent molecules, differing by degree of distortion, have been found present in one crystal in five exampales.[242,249,252,262,269] The complex Zn(terpy)Cl_2[263,264] exists in two isomeric forms which differ only by distortions in the Zn-L distances and L-Zn-L angles.

It is noted that while the square-pyramidal zinc(II) compounds are mostly purple or violet in colour, the trigonal bipyramidal compounds are mostly colourless. The former are mostly comprised of electron withdrawing ligands which are responsible for the colour.

3.3 *Coordination Number Six*

Crystallographic and structural data for almost one hundred mononuclear six coordinated zinc(II) compounds are gathered in Table 3. Most of these are colourless, with a few examples of white, yellow (four each), orange and red (one each). The three principle types of distortion from the octahedron are, trigonal, rhombic and tetragonal, all of which are found in zinc complex chemistry. There are some examples with O_h symmetry.

The data in Table 3 show mono-, bi-, tri-, tetra- and even pentadentate ligands. The most common coordination sphere of the zinc(II) atom is the ZnO_6 chromophore and the most common ligands is water.

Table 3 Crystallographic and structural data hexa-coordinated zinc(II) compounds[a].

COMPOUND (colour)	Crys. cl Sp.Grp Z	a[Å] b[Å] c[Å]	α[°] β[°] γ[°]	Chromo-phore		Zn-L [Å]		L-Zn-L [°]	Ref.
$[Zn(H_2O)_6]\cdot$	*tr*	6.46(1)	92.5(2)	ZnO_6	H_2O^b	2.09(1,1)	O,O^b	91.5(5,1.8)	279
$(adc)_2\cdot 2H_2O$	$P\bar{1}$	5.96(1)	105.0(3)						
(not given)	1	11.15(2)	91.3(2)						
$[Zn(H_2O)_6]\cdot$	*m*	22.5		ZnO_6	H_2O	2.08	not given		280
$(PhSO_3)_2$	$P2_1/n$	6.32	93.36						
(colourless)	2	6.98							
$[Zn(H_2O)_6]\cdot$	*m*	25.24(1)		ZnO_6	H_2O	2.05	O,O	89(-,1)	281
$(MeC_6H_4SO_3)_2$	$P2_1/n$	6.295(2)	91.18(15)			2.08			
(colourless)	2	6.98				2.14			
$[Zn(H_2O)_6]\cdot$	*trg*	10.884(1)		ZnO_6	H_2O	2.086(2,0)	O,O	90.0(1,1.1)	282
$[ZnCl_3(taa)]_2\cdot$	$P\bar{3}$	—							
$6H_2O$	1	8.784(1)		$ZnCl_3N$	Cl	2.246(1,0)	Cl,Cl	112.6(1)	
(not given)					N	2.102(5)	Cl,N	106.2(1)	
$[Zn(dmso)_6]\cdot$	*tr*	12.006(3)		ZnO_6	O	2.098(3,0)	O,O	90.0 (5,4.8)	283
$(ClO_4)_2$	*P*31*c*	—				2.121(3,0)		176.1(3)	
(colourless)	2	12.578(5)							
$[Zn(pyNO)_6]\cdot$	*trg*	9.632(2)	81.07(2)	ZnO_6	O	2.086(1,0)	O,O	90.0(4,4)	284
$(ClO_4)_2$	$R\bar{3}$								
(colourless)	1								
$[Zn(4\text{-}MepyNO)_6]\cdot$	*m*	9.467(5)		ZnO_6	O	2.068(7,0)	O,O	90.0 (3,2.4)	285
$(ClO_4)_2$	$P2_1/c$	10.760(5)	92.46(4)			2.113(7,0)			
(colourless)	2	20.531(9)				2.160(7,0)			
$[Zn(S_2N_2CO)_6]\cdot$	*trg*	11.901(1)		ZnO_6	O	not given	O,O	90.0(–,1.4)	286
$(AsF_6)_2$	$P\bar{1}$	—							
(colourless)	1	6.651(1)							
$Zn(H_2O)_4$	*m*	5.138(3)		ZnO_6	H_2O	2.036(7,3)	O,O	90.0(3,5.7)	287
$\{(2\text{-}ClC_4H_5O_4)ae\}_2$	$P2_1$	27.40(1)	107.28(5)			2.127(9,11)		178.8(3,8)	
(not given)	2	7.406(6)			O	2.134(9,4)			
$Zn(H_2O)_4$	*m*	14.173(6)		ZnO_6	H_2O	2.121(4,38)	O,O	90.0(1,4.2)	288
(ts-β-ala)$_2$	$P2_1/c$	5.469(2)	106.63(3)		O	2.083(4,0)			
(not given)	2	17.701(7)							
$Zn(H_2O)_4(mal)_2$	*tr*	7.3215(6)	104.63(2)	ZnO_6	H_2O	2.046(4)	O,O	90.0(1,6.6)	289
(not given)	$P\bar{1}$	9.2240(11)	93.19(2)			2.127(4)			
	1	5.2270(3)	108.72(2)		O	2.143(4)			

Table 3 *Continued*

COMPOUND (colour)	Crys. cl Sp.Grp Z	a[Å] b[Å] c[Å]	α[°] β[°] γ[°]	Chromo-phore		Zn-L [Å]		L-Zn-L [°]	Ref.
$[Zn(H_2O)_4$	m	23.891(8)		ZnO_6	H_2O	2.082(4)	O,O	90.0(2,1.4)	290
$(\beta\text{-ala})_2]\cdot(NO_3)_2$	$P2_1/n$	6.576(2)	95.67(3)			2.165(4)			
(colourless)	2	5.519(2)			O	2.072(4)			
$Zn(H_2O)_4$(ofpa)	m	5.044(1)		ZnO_6	H_2O	2.136(8,37)	O,O	90.0(2,5.3)	291
(colourless)	$P2_1$	13.481(3)	96.95(2)		O	2.080(8,34)		175.5(2,3.1)	
	2	15.055(4)							
$[Zn(H_2O)_4(ofpa)_2]\cdot$	m	6.597(2)		ZnO_6	H_2O	2.077(2,8)	O,O	90.0(1,1.9)	292
$2H_2O$	$P2_1/c$	5.279(2)	94.65(3)		O	2.122(2,0)			
(colourless)	2	30.079(10)							
$Zn(H_2O)_4$(fum)	m	7.58(2)		ZnO_6	H_2O	2.08(2)	O,O	90.0(6,2.3)	293
(colourless)	$P2_1/c$	14.46(3)	101.2(1)			2.16(2,2)		176.6(6,2.2)	
	4	7.66(2)			O	2.05(2,1)			
$Zn(sal)_2(H_2O)_2$	m	15.450(18)		ZnO_6	O	1.982(4)	O,O	120.93(17)	294
(white)	$C2$	5.341(3)	93.55(7)			2.523(4)		131.56(16)	
	2	9.164(3)			H_2O	1.998(4)			
[Zn(4-Fpac)$_2$)	or	11.648(7)		ZnO_6	O	2.107(2)	O,O	58.6(1)[c]	295
$(H_2O)_2]\cdot 2H_2O$	Pbca	5.2052(8)				2.332(2)		84.1–143.0(1)	
(not given)	4	28.			H_2O	1.989(4)			
$Zn(bta)_2(H_2O)_2$	m	38.17(1)		ZnO_6	O	2.138(3)	O,O	58.8(1)[c]	296
(colourless)	$C2/c$	5.140(1)	94.30(1)			2.228(3)		87.6–144.4(1)	
	4	10.604(3)			H_2O	1.996		170.2(1)	
$Zn(fmpa)_2(H_2O)_2$	m	20.090(4)		ZnO_6	O	2.073(2)	O,O	58.4(2)[c]	287
(not given)	$I2$	5.402(1)	107.52(2)			2.381(2)		34.9–149.8(1)	
	2	10.306(2)			H_2O	1.997(2)			
$Zn(H_2NCOCO_2)_2$	tr	6.309(3)	74.67(20)	ZnO_6	O	2.043(6)	O,O	80.2(1)[d]	297
$(H_2O)_2$	$P\bar{1}$	7.777(2)	76.16(20)			2.152(6)		91.1(1,4)	
(not given)	1	4.970(2)	81.56(12)		H_2O	2.088(5)			
$Zn(pac)_2(H_2O)$	m	11.625(3)		ZnO_6	O	2.118(1)	O,O	58.6(1)[c]	298
(colourless)	$C2$	5.221(1)	101.05(5)			2.337(1)		84.7–142.5(1)	
	2	13.767(4)			H_2O	1.994(1)			
Zn(p-Clpac)$_2$	m	11.64(1)		ZnO_6	O	not given	not given		298
$(H_2O)_2$	$C2$	5.21(1)	100.8(1)						
(colourless)	2	15.42(2)							
$Zn(MeCO_2)_2$	m	14.50		ZnO_6	O	2.17	O,O	61[c]	299
$(H_2O)_2$	$C2/c$	5.32	100.0			2.18		85–158	
(colourless)	4	11.02			H_2O	2.14		172	

Table 3 *Continued*

COMPOUND (colour)	Crys. cl Sp.Grp Z	a[Å] b[Å] c[Å]	α[°] β[°] γ[°]	Chromo-phore		Zn-L [Å]		L-Zn-L [°]	Ref.
$Zn(p\text{-}NO_2benz)_2(H_2O)_2$ (not given)				ZnO_6	O	2.006(5,4) 2.517(5,6)	O,O	not given	300
					H_2O	1.995(8,1)			
$[Zn(lac)_2(H_2O)_2]\cdot H_2O$ (colourless)	*m* $P2_1/c$ 4	9.38(1) 5.83(1) 22.00(2)	90.9(1)	ZnO_6	O H_2O	2.987(-,6) 2.174(-,20) 2.057(-,17)	O,O	not given	301
$Zn(C_{15}H_{11}O_4)_2(EtOH)_2$ (yellow)	*tr* $P\bar{1}$ 2	13.028(2) 11.872(2) 10.971(2)	102.28(1) 87.14(1) 112.53(2)	ZnO_6	O EtHO	2.020(5,9) 2.177(6,3)	O,O	88.2(2,1)[e] 90.4(2,4.7)	302
$Zn(tta)_2(MeOH)_2$ (not given)	*tr* $P\bar{1}$ 2	12.006(3) 10.435(4) 10.335(4)	97.82(20) 113.25(23) 98.99(20)	ZnO_6	O MeHO	2.046(4,1) 2.096(4,6) 2.081(4,1)	O,O	87.0(1,5)[e] 90.6(1,4.9)	303
$[Zn(C_2H_6O_2)_3]\cdot SO_4$ (colourless)	*or* *Ac2a* 4	9.544(1) 14.198(1) 9.180(1)		ZnO_6	O	2.091(4,8)	O,O	78.7(2,1)[d] 94.2(2,4.5) 169.8(2,3.7)	304
$Zn(NO_3)_2(apy)_2$ (colourless)	*tg* $P4_1$ 4	9.94(2) — 25.50(10)		ZnO_6	$(NO_3)O$ apyO	2.028(19) 2.223(32,53) 2.523(2) 1.925(17,15)	O,O	86.8- 149.3(2.6)	305[a]
$Zn(damal)_2(NO_3)_2$ (colourless)	*tr* $P\bar{1}$ 1	7.098(1) 7.258(1) 7.650(1)	90.65(1 116.28(1) 105.60(1)	ZnO_6 (NO_3)	O O	2.047(1,15) 2.203(1)	O,O	90.0(1,4.0)	305[b]
$[Zn(hfac)_2(ntp)\cdot(H_2O)]$ (red)	*m* $P2_1/n$ 4	13.917(4) 15.885(9) 15.475(3)	99.10(3)	ZnO_6	hfaO (ntp)O H_2O	2.093(8,21) 2.103(7,40) 2.035(2)	O,O	86.4(3,5)[e] 89.8(3,7.5) 173.9(3,9)	306[a]
$[Zn(Ph_3P_2O_2)_3]\cdot(AsF_6)_2$ (not given)	*trg* $P\bar{3}1c$ 2	11.967(3) — 21.202(3)		ZnO_6	O	2.083(6)	O,O	90.0(2,2.5) 175.8(2)	306[b]
$[Zn(im)_6]Cl_2\cdot 4H_2O$ (colourless)	*tr* $P\bar{1}$ 1	10.7 9.4 8.8	120 97 98	ZnN_6	N	2.179(35,26) 2.229(35,35)	N,N	90.0(1,1,2.8) 177.7(8,1.7)	307
$[Zn(im)_6]Cl_24H_2O$ (colourless)	*tr* $P\bar{1}$ 1	10.635(6) 9.231(4) 8.835(4)	119.53(2) 96.85(4) 97.87(4)	ZnN_6	N	2.183(2) 2.196(2) 2.199(2)	N,N	90.0(1,7)	308

Table 3 *Continued*

COMPOUND (colour)	Crys. cl Sp.Grp Z	a[Å] b[Å] c[Å]	α[°] β[°] γ[°]	Chromo-phore		Zn-L [Å]		L-Zn-L [°]	Ref.
$Zn(Et_2nia)_4(NCS)_2$	*or*	20.920(2)		ZnN_6	N	2.235(13,52)	N,N	not given	309
(not given)	$P2_12_12_1$	23.777(3)			SCN	2.104(11,19)			
	4	9.529(1)							
$[Zn(2\text{-pia})_3]Cl_2 \cdot EtOH$	*m*	11.906(3)		ZnN_6	N	2.143(5,14)	N,N	76.4(2,9)[d]	310
(white)	$P2_1/c$	21.929(2)	124.65(2)			2.214(5,7)			
	4	11.557(2)							
$[Zn(en)_3] \cdot (p\text{-}H_2Nbenz)_2 \cdot H_2O$	*or*	10.834(4)		ZnN_6	N	2.198(10,22)	N,N	80.3(3,7)[d]	311
	$Pna2_1$	27.82(1)						93.5(3,4.3)	
(not given)	4	8.826(3)						168.8(3,2.3)	
$[Zn(bispicam)_2](ClO_4)_2$[f]	*m*	23.715(6)		ZnN_6	N	2.150(5)	N,N	79.8(2)[d]	312
(not given)	*C*2/*c*	9.006(2)	91.52(3)			2.158(5)		95.1(2,8.1)	
	8	26.052(11)				2.160(5)			
				ZnN_6	N	2.133(5)	N,N	74.2(2,6)[d]	
						2.168(5)		86.9–150.4(2)	
						2.311(6)			
$[Zn(bispicam)_2] \cdot Cl_2 \cdot 6H_2O$	*m*	9.175(2)		ZnN_6	N	2.154(4)	N,N	79.8(2)[d]	312
(not given)	$P2_1/c$	10.088(2)	94.54(1)			2.164		95.1(2,10.7)	
	2	16.472(3)				2.207(5)			
$[Zn(C_8H_{21}N_3)_2] \cdot (ClO_4)_2$	*c*	13.870(2)		ZnN_6	N	2.213(4)	N,N	90.0(3,5.2)	22[b]
(colourless)	$Pa\bar{3}$							180.8	
	4								
$[Zn(C_6H_{15}N_3)_2] \cdot (PF_6)_2$	*m*	9.719(2)		ZnN_6	N	2.170(5,13)	N,N	80.3(2,4)[d]	313
(colourless)	*C*2/*c*	16.312(3)	92.04					99.6(2,2)	
	4	15.017(3)						180.0(1)	
$[Zn(C_{12}H_{11}N_5)_2] \cdot (NO_3)_2$	*tr*	9.513(4)	96.85(3)	ZnN_6	N	2.142(4,13)	N,N	84.5(2,7)[d]	314
(colourless)	$P\bar{1}$	8.965(4)	91.03(3)					95.5(2,7)	
	1	8.957(3)	113.31(3)						
$[Zn(C_{12}H_{11}N_5)_2] \cdot (NO_3)_2$	*m*	10.129(3)		ZnN_6	N	2.139(8,24)	N,N	84.5(3,1.0)[d]	314
(colourless)	$P2_1/c$	8.007(2)	112.15(3)					95.5(3,1.0)	
	2	18.788(9)							
$[Zn(dien)_2] \cdot Br_2H_2O$	*m*	13.81(1)		ZnN_6	N	2.22(4,9)	N,N	80(1,1)[d]	315
(not given)	$P2_1/c$	8.914(4)	101.23(3)					96(1,9)	
	4	14.281(6)						166(1,12)	

Table 3 *Continued*

COMPOUND (colour)	Crys. cl Sp.Grp Z	a[Å] b[Å] c[Å]	α[°] β[°] γ[°]	Chromo-phore		Zn-L [Å]		L-Zn-L [°]	Ref.
$Zn(C_{10}H_{34}N_4)(NCS)_2$[f]	*or*	14.502(2)		ZnN_6	N	2.104(13,34)	N,N	83.6(4,2)[d]	316
(white)	$P2_1nb$	18.163(2)			SCN	2.166(13)		94.6(4,1.6)[e]	
	4	6.522(1)				2.576(13)		89.1(4,7.6)	
								172.3(4,5.6)	
				ZnN_6	N	2.105(16,59)	N,N	84.7(6,2.4)[d]	
					SCN	2.214(15)		94.5(6,4)[e]	
					SCN	2.529(16)		90.0(6,7.8)	
								172.0(7,4.8)	
$Zn(C_{11}H_{26}N_4)(NCS)_2$	*m*	14.453(2)		ZnN_6	N	2.146(5,39)	N,N	82.8(2)[d]	316
(white)	$P2_1/a$	14.436(1)	104.823(9)		SCN	2.095(5)		91.8(2,5.0)	
	4	9.213(1)				2.479(6)		90.1(2,9.8)	
								169.6(2,5.1)	
$[Zn\{(py)_3tach\}]\cdot(ClO_4)_2$	*m*	13.440(5)		ZnN_6	N	2.152(4,15)	N,N	74.3(2,9)[d]	317
(not given)	$P2_1/c$	13.738(5)	109.89(4)			2.250(4,41)		82.6(2,1.4)	
	4	15.279(6)						92.0(2,2.4)	
$[Zn(C_{12}H_{34}N_6)]\cdot(ClO_4)_2\cdot H_2O$	*m*	9.488(4)		ZnN_6	N	2.100(5,5)	N,N	80.0(2,1.4)[d]	318
	$P2_1/c$	14.736(4)	97.95(3)			2.214(5,14)		95.2(2,8.9)	
(colourless)	4	16.037(4)						177.7(2,1.6)	
$[Zn\{FB(ONCHC_5H_3N\}_3P](BF_4)$	*m*	13.340(22)		ZnN_6	N	2.085(8,28)	N,N	76.4(3,1.4)[d]	319
	$P2_1/c$	17.92(13)	108.60(7)					81.1(3,,1.6)	
(colourless)	4	10.622(14)						88.2–136.4(3)	
$[Zn(ac)_2(er)(H_2O)]\cdot 2C_4H_{10}O\cdot 2H_2O$	or	13.357(3)		ZnO_5N	acO	2.100(6,76)	O,O	61.2(2)[c]	320
	$P2_12_12_1$	20.013(6)			erO	2.178(4)		78.5–168.3(2)	
(colourless)	4	22.052(10)			erN	2.124(6)	O,N	81.2(2)[d]	
					H_2O	2.157(5)		94.6–152.9(2)	
$[Zn(thgly)(H_2O)_3]\cdot H_2O$	*or*	7.589(7)		ZnO_5S	O	2.066(5,37)	O,O	92.2(2,7.1)	321
(not given)	$P2_12_12_1$	9.289(8)			S	2.601(2)	O,S	79.7(1,1.5)[d]	
	4	14.168(11)			H_2O	2.055(5,43)		91.6(1,6)	
$Zn(H_2O)_4(C_6H_4O_2N)_2$	*m*	9.724(19)		ZnO_4N_2	H_2O	2.08(1)		not given	322
(colourless)	$P2_1/c$	5.221(13)	124.02(13)			2.18(1)			
	2	17.429(31)			N	2.10(1)			
$Zn(H_2O)_4(nic)_2$	*m*	14.195(2)		ZnO_4N_2	H_2O	2.08(1)	O,O	90.5(6,1)	323
(colourless)	*C*2	6.900(1)	118.192(9)			2.20(1)		176.7(3)	
	2	8.482(2)			N	2.156(4)	N,N	177.2(9)	
							O,N	90.0(4,2.9)	

Table 3 *Continued*

COMPOUND (colour)	Crys. cl Sp. Grp Z	a[Å] b[Å] c[Å]	α[°] β[°] γ[°]	Chromo-phore		Zn-L [Å]		L-Zn-L [°]	Ref.
$Zn(H_2O)_4(nic)_2$	*m*	14.160(4)		ZnO_4N_2	H_2O	2.117(1)	O,O	89.05(4)	324
(colourless)	*C*2/*m*	6.813(3)	117.97(2)		N	2.145(2)	N,N	~180	
(at 120 K)	2	8.464(4)					O,N	91.25(5)	
$Zn(H_2O)_4(3\text{-}SO_3py)_2$	*m*	8.60(5)		ZnO_4N_2	H_2O	2.136(9,5)	O,O	89.7(4)	325
(not given)	$P2_1/n$	12.74(4)	97.0(5)		N	2.092(10)	N,N	~180	
	n	7.55(5)					O,N	87.0(4,7)	
$[Zn(H_2O)_4(sach))_2]\cdot 2\ H_2O$	*m*	7.934(1)		ZnO_4N_2	H_2O	2.058(2)	O,O	88.75(7)	326
(not given)	$P2_1/c$	16.118(3)	99.90(1)			2.159(2)	N,N	~180	
	2	7.691(1)			N	2.201(2)	O,N	87.8(1,3)	
$[Zn(H_2O)_4(sach)_2]\cdot 2\ H_2O$	*m*	7.939(2)		ZnO_4N_2	H_2O	2.059(4)	O,O	91.3(2)	327
(not given)	$P2_1/c$	16.120(2)	99.87(2)			2.159(4)	N,N	~180	
	2	7.691(2)			N	2.200(4)	O,N	89.8(2,2.2)	
$[Zn(H_2O)_4(xan)_2]\cdot 2\ H_2O$	*tr*	8.065(1)	81.52(1)	ZnO_4N_2	H_2O	2.074(5,4)	O,O	90.0(2,5.5)	328
(colourless)	*P*1	8.502(1)	84.67(1)			2.132(5,19)	N,N	177.9(2)	
	1	11.066(1)	82.73(1)		N	2.176(6,10)	O,N	90.0(2,5.1)	
$Zn(H_2O)_4$	*m*	7.706(2)		ZnO_4N_2	H_2O	2.117(1)	O,O	90.0(1,4.2)	329
$(ahxan)_2$	$P2_1/c$	14.020(3)	116.4(2)			2.148(1)	N,N	~180	
(colourless)	2	7.061(2)			N	2.135(1)	O,N	90.0(1,3.6)	
$Zn(damal)_2(NCS)_2$	*m*	8.513(4)		ZnO_4N_2	O	2.091(4,10)	O,O	87.8(1)[e]	305[b]
(colourless)	$P2_1/a$	8.301(4)			SCN	2.109(5)	N,N	~180	
	2	11.294(4)	109.28(7)				O,N	88.2(2,3)	
$Zn(NO_2)(py)_2$	*tr*	12.198(5)	67.08(3)	ZnO_4N_2	O	2.076(3,6)	O,O	52.1(1,2)[c]	330
(colourless)	$P\bar{1}$	7.953(3)	87.41(3)		O	2.341(3,21)		92.8(1,5.0)	
	2	7.573(3)	88.18(4)		pyN	2.065(3,3)		140.9(1)	
							N,N	102.7(1)	
							O,N	98.3(1,11.9), 150.3(1)	
$Zn(NO_2)_2(2\text{-}Mepy)_2$	*m*	14.184(2)		ZnO_4N_2	O	2.021(2)	O,O	53.6(1)[c]	330[a]
(colourless)	*C*2/*c*	7.853(1)	112.14(1)			2.497(2)		86.4(1,5.2)	
	4	15.000(2)			N	2.071(2)		132.58(9)	
							N,N	112.2(1)	
							O,N	98.1(1.9.8), 151.3(1)	

Table 3 *Continued*

COMPOUND (colour)	Crys. cl Sp. Grp Z	a[Å] b[Å] c[Å]	α[°] β[°] γ[°]	Chromo-phore		Zn-L [Å]		L-Zn-L [°]	Ref.
$Zn(NO_2)_2(Me_4en)$	*m*	7.767(2)		ZnO_4N_2	O	2.072(2,0)	O,O	56.4(1,5)[c]	330[b]
(colourless)	$P2_1/n$	12.145(3)	92.75(2)			2.302(2,37)		92.0(1,2.9)	
	4	12.623(2)			N	2.107(2,3)		139.39(8)	
							N,N	85.79(8)[d]	
							O,N	102.0(1,5.6)	
								158.7(1,3)	
$Zn(hfac)_2(py)_2$	*m*	9.2027(5)		ZnO_4N_2	O	2.069(8)	O,O	84.3(3)[e]	331
(colourless)	*C*2/*c*	17.512(1)	105.78(1)			2.159(7)		81.7,171.2(3)	
	4	16.518(1)			pyN	2.116(7)	N,N	99.0(4)	
							O,N	92.5(4,2.7)	
$Zn(ttfa)_2(py)_2$	*tr*	14.571(3)	132.73(21)	ZnO_4N_2	O	2.097(9,28)	O,O	85.6(3,7)[e]	332
(not given)	$P\bar{1}$	10.232(3)	92.82(18)		N	2.156(11,31)	N,N	not given	
	2	12.788(4)	91.66(18)				O,N	not given	
$Zn(ttfa)_2(4\text{-}Mepy)_2$	*m*	9.411(4)		ZnO_4N_2	O	2.066(6)	O,O	86.6[e]	333
(colourless)	*C*2/*c*	17.789(5)	94.795(5)			2.118(7)		87.9(–,3.9)	
	4	18.131(6)			N	2.137(7)	N,N	95.0	
							O,N	90.8(–6)	
$Zn(NO_3)_2(C_5H_8N_2S)_2$	*or*	16.259(5)		ZnO_4N_2	O	2.03	O,O	52.4(–1.6)[c]	334
(not given)	$Pna2_1$	9.333(5)				2.30(-,6)		91.4(–5.5)	
	4	12.019(5)				2.66	N,N	106.6	
					N	2.00(–,2)	O,N	82.7–143.3	
$[Zn(pm)_2(H_2O)_2]\cdot(NO_3)_2$	*m*	15.790(4)		ZnO_4N_2	O	2.174(4)	O,O	90.0(2)	335
(colourless)	$P2_1/n$	4.777(2)	95.04(6)		N	2.061(5)	N,N	not given	
	2	15.058(9)			H_2O	2.171(5)	O,N	88.6(2)[e]	
$Zn(C_5H_8NO_4)_2(H_2O)_2$	*or*	17.537(4)		ZnO_4N_2	O	2.011(2)	not given		336
(colourless)	Pbca	11.596(4)			N	2.244(2)			
	4	7.310(5)			H_2O	2.136(2)			
$Zn(pyac)_2(H_2O)_2$	*m*	8.38(2)		ZnO_4N_2	O	2.075(5)	O,O	86.1(3)	337
(colourless)	$P2_1/c$	7.12(1)	115.53(10)		N	2.092(14)	N,N	not given	
	2	13.19(3)			H_2O	2.212(6)	O,N	90.0(3,1.9)	
$Zn(8\text{-}OHqu)_2(H_2O)_2$	*m*	13.16		ZnO_4N_2	O	2.066	O,O	90.8	338
(colourless)	$P2_1/c$	5.42	106.18		N	2.099	N,N	not given	
	2	11.28			H_2O	2.263	O,N	81.5[d]	
								93.3	
$Zn(8\text{-}OHqu)_2(H_2O)_2$	*m*			ZnO_4N_2	O	2.05	O,O	94.6	339
(colourless)	$P2_1/a$				N	2.06	N,N	not given	
	2				H_2O	2.27	O,N	79.8[d]	
								92.7	

Table 3 *Continued*

COMPOUND (colour)	Crys. cl Sp. Grp Z	a[Å] b[Å] c[Å]	α[°] β[°] γ[°]	Chromo-phore		Zn-L [Å]		L-Zn-L [°]	Ref.
$[Zn(C_5H_5N_4O_3)_2(H_2O)_2]\cdot$ 2 H_2O	*tr*	11.4430(6)	102.1(2)	ZnO_4N_2	O	2.121(3,25)	O,O	89.9(1,1.3)	340
	*P*1	9.5610(4)	94.1(1)		N	2.124(3,1)	N,N	170.6(1)	
(colourless)	2	8.1430(2)	97.6(1)		H_2O	2.132(3,2)	O,N	77.6(1,5)[d]	
								95.5(1,15.9)	
$(NH_4)_2[Zn(C_{10}H_5NO_5S)_2\cdot$ $(H_2O)_2]$	*m*	20.301(5)		ZnO_4N_2	O	2.123(9)	O,O	91.2(4)	341
	$P2_1/c$	7.287(2)	95.85(4)		N	2.164(1)	N,N	not given	
(colourless)	2	8.256(4)			H_2O	2.091(10)	O,N	77.4(4)[d]	
								91.7(4)	
$Zn(L\text{-}tre)_2(H_2O)$	*m*	5.875(1)		ZnO_4N_2	O	2.124(12,11)	O,O	90.8(4,2.1)	342
(colourless)	$P2_1$	22.275(10)	119.69(4)		N	2.100(11,15)	N,N	173.1(4)	
	2	5.807(1)			H_2O	2.156(15,4)	O,N	78.5(5)[d]	
								93.8(5,5.3)	
$[Zn(pc)_2(H_2O)_2]\cdot 2\ H_2O$	*m*	9.808(2)		ZnO_4N_2	O	2.089(13)	O,O	89.2(5)	343
(colourless)	$P2_1/c$	5.221(1)	123.88(1)		N	2.114(13)	N,N	not given	
	2	17.584(3)			H_2O	2.176(11)	O,N	80.0(5)[d]	
								95.3(6)	
$[Zn(C_8H_{12}N_2O_3)_2(H_2O)_2]\cdot$ 2 H_2O	*m*	9.989(2)		ZnO_4N_2	O	2.07(–,1)	O,O	85.7(–,1.7)	344
	$P2_1$	8.993(2)	110.87(2)		N	2.08(–,2)	N,N	not given	
(orange)	2	13.478(3)			H_2O	2.17(–,4)	O,N	77,7(–1)[d]	
$Zn(C_6H_4CHONC_6H_4OMe)_2$	*m*	12.727(4)		ZnO_4N_2	O	1.973(–,8)	O,N	92.3(–,9)[e]	345
(yellow)	$P2_1/c$	12.552(4)	94.1(2)			2.406(–,1)		97.2(–,1.2)	
	4	14.806(5)			N	2.048(–,2)			
$Zn(biuret)_2Cl_2$	*m*	8.02(1)		ZnO_4Cl_2	O	2.037(11,10)	O,O	87.1(3)[e]	346
(not given)	$P2_1/c$	7.26(1)	124.7(1)		Cl	2.529(3)	Cl,Cl	~180	
	2	11.54(1)					O,Cl	90.0(3,3)	
$[Zn(Et_2nia)_2(NCS)_2\cdot(H_2O)_2]$	*tr*	7.626(7)	98.7(1)	ZnN_4O_2	N	2,171(4)	N,N	90.4(1)	347
(not given)	$P\bar{1}$	11.998(10)	123.7(1)		SCN	2.107(5)	O,O	not given	
	1	9.486(8)	97.2(1)		H_2O	2.129(3)	N,O	87.5(1,6)	
$[Zn(phen)_2(H_2O)_2]\cdot 6\ H_2O$	*tr*	10.070(4)	109.12(2)	ZnN_4O_2	N	2.143(4,7)	N,N	76.8(1,0)[d]	348
(colourless)	$P\bar{1}$	12.280(3)	92.52(2)			2.192(4,1)		92.1(1,2.9)	
	2	13.358(2)	110.85(2)		H_2O	2.043(3)	O,O	85.6(1)	
						2.138(3)	N,O	94.7(1,8.5)	
								168.4(1,2.9)	

Table 3 *Continued*

COMPOUND (colour)	Crys. cl Sp. Grp Z	a[Å] b[Å] c[Å]	α[°] β[°] γ[°]	Chromo-phore		Zn-L [Å]		L-Zn-L [°]	Ref.
$[Zn(C_5H_8N_4O)_2(H_2O)_2]\cdot Cl_2\cdot 2\ H_2O$	*tr*	8.912(3)	93.11(5)	ZnN_4O_2	N	2.086(4)	N,N	77.7(2)[d]	349
(colourless)	$P\bar{1}$	9.298(2)	102.14(4)			2.178(5)		102.3(2)	
	1	6.821(5)	114.33(2)		H_2O	2.165(4)	O,O	~180	
							N,O	90.0(2,1.8)	
$Zn(dmen)_2(NO_2)_2$	*m*	8.635(4)		ZnN_4O_2	N	2.088(3)	N,N	82.4(1)[d]	350
(colourless)	$P2_1/c$	9.508(4)	109.70(3)			2.284(3)	N,O	86.3(1,4)	
	2	9.33(4)			$(NO_2)O$	2.221(3)			
$[Zn(en)_2(NO_2)]\cdot(NO)$	*m*	9.033(4)		ZnN_4O_2	N	2.101(3)	N,N	82.2(2)[d]	350
(colourless)	*C*2/*c*	13.431(6)	107.98(3)			2.138(7)		101.8(2,4.8)	
	4	10.105(4)			O	2.240(5)	O,O	55.2(2)[c]	
							N,O	93.5(2,5.8), 154.1(2)	
$[Zn(en)_2(NO_2)]\cdot ClO_4$	*tr*	10.181(2)	115.60(1)	ZnN_4O_2	N	2.127(4,24)	N,N	81.8(1,7)[d]	330[b]
(colourless)	$P\bar{1}$	8.805(2)	103.26(1)		O	2.263(4,12)		100.5(1,6.4)	
	2	8.561(2)	99.44(1)					176.7(3)	
							O,O	54.6(1)[c]	
							N,O	93.8(1,7.9)	
								152.7(1,1.8)	
$[Zn(bpy)_2(NO_2)]\cdot NO_3$	*m*	14.292(3)		ZnN_4O_2	N	2.084(3,2)	N,N	78.2(4,3)[d]	351
(colourless)	$P2_1/n$	11.962(4)	101.16(2)			2.131(3,5)		100.5(4,2)	
	4	15.384(5)			O	2.214(3,10)	O,O	56.5(4)[c]	
							N,O	94.2(4,9.2)	
								155.4(3,3,0)	
$[Zn(phen)_2(cat)]\cdot 2\ C_6H_4(OH)_2$	*tr*	11.837(3)	101.21(2)	ZnN_4O_2	N	2.164(9,2)	N,N	76.2(3,6)[d]	352
(yellow)	$P\bar{1}$	12.629(3)	100.20(2)			2.214(9,7)		95.6(3,1.3)	
	2	14.449(4)	?		O	2.070(8,22)	O,O	81.5(3)[d]	
							N,O	93.9(3,3.9)	
								166.3(3,5)	
$Zn(H_2NHHCO_2)_2(N_2H_4)_2$	*m*	8.412(4)		ZnN_4O_2	N	2.17(2)	N,N	94.2(1.0)	353
(colourless)	$P2_1/c$	7.384(5)	125.45(27)			2.25(4)	N,O	77.8(1.8)[d]	
	2	9.582(10)			O	2.05(2)		93.8(8)	
$K[Zn(H_2NNHCO_2)_3]\cdot$	*trg*	10.325							353
(colourless)	*R*3*c*	—							
	6	17.024							

Table 3 *Continued*

COMPOUND (colour)	Crys. cl Sp. Grp *Z*	*a*[Å] *b*[Å] c[Å]	α[°] β[°] γ[°]	Chromo-phore		Zn-L [Å]		L-Zn-L [°]	Ref.
$[Zn(phen)_2(ae)]\cdot BF_4\cdot 2\ H_2O$	*m*	9.659(2)		ZnN_4O_2	N	2.116(2)	N,N	113.04(4)	354
(not given)	$P2_1/c$	8.262(2)	109.06(5)			2.147(2)	O,O	not given	
	2	17.651(2)			O	2.184(2)	N,O	94.7(1)	
								151.2(1)	
$[Zn(C_{18}H_{14}N_4)(H_2O)_2]\cdot$	m	9.048(4)		ZnN_4O_2	N	2.154(4)	N,N	72.8(2)[d]	355
$(CF_3SO_3)_2$	$P2_1/a$	22.126(9)	91.30(3)			2.269(4)		139.4(2)	
(colourless)	4	14.476(4)			H_2O	2.044(4,22)	O,O	151.8(2)	
							N,O	93.2(2,12.5)	
								139.4(2)	
$Zn(tpp)(thf)_2$	*tr*	9.572(1)	102.71(2)	ZnN_4O_2	N	2.057(2,1)	N,N	90.6(1)[e]	356
(not given)	$P\bar{1}$	11.115(2)	103.78(2)		thfO	2.380(2)	O,O	~180	
(at 143K)	1	11.720(3)	115.01(1)				N,O	87.0(1,1)	
$Zn(phen)(pyt)_2$	*m*	15.116(2)		ZnN_4S_2	phenN	2.182(7,20)	N,N	75.8(2)[d]	357
(not given)	$P2_1/c$	9.918(2)	128.20(3)		pytN	2.107(7,22)		96.1(3,5.4)	
	4	14.181(3)			pytS	2.586(3,40)	S,S	160.22(9)	
							N,S	65.9(2,8)[c]	
								98.9(2,4.9)	
$Zn(Bu_2NCS_2)_2(phen)$	*or*	15.386(9)		ZnS_4N_2	S	2.516(4)	S,S	70.8(1)[c]	358
(yellow)	Pbcn	22.487(18)				2.530(4)		107.8(3)	
	4	9.923(6)			N	2.218(1)	N,N	73.9(1)	
							S,N	93.5(3,10.4)	
								148.8(3)	
$Zn(C_{20}H_{27}N_3O_2)(NO_3)_2$	*m*	17.512(5)		ZnO_3N_3	NO_3O	2.179(6)	O,O	57.3(2)[c]	359
(colourless)	$P2_1/n$	8.287(3)	93.10(2)			2.240(5,13)		84.4(2,2.8)	
	4	15.927(4)			N	2.087(5,2)	N,N	84.0(2,2.1)[d]	
						2.225(5)		99.7(2)	
							O,N	96.7(2,4.4)	
								164.8(2,10.6)	
$[Zn(MeCONHNH_2)_3]\cdot$	*tr*	9.140(2)	83.50(1)	ZnO_3N_3	O	2.118(3,2)	O,O	96.2(1)	360
$S_2O_6\cdot 2{,}5H_2O$	$P\bar{1}$	10.278(7)	81.51(1)		N	2.143(4,32)	N,N	97.1(1,3.0)	
(colourless)	4	20.834(2)	93.67(1)				O,N	77.8(1,2)[d]	
								93.6(1,4.9)	
				ZnO_3N_3	O	2.098(4,4)	O,O	92.8(1,3.3)	
					N	2.166(4,3)	N,N	96.4(1,6)	
							O,N	77.5(1,4)[d]	
								94.7(1,3.4)	

Table 3 *Continued*

COMPOUND (colour)	Crys. cl Sp. Grp Z	a[Å] b[Å] c[Å]	α[°] β[°] γ[°]	Chromo-phore		Zn-L [Å]		L-Zn-L [°]	Ref.
$[Zn(PHCO_2)(H_2O)\cdot$	*tr*	8.193(2)	79.53(3)	ZnO_3N_3	O	2.073(4,2)	O,O	94.7(2,1.0)	313
$(C_9H_{21}N_3)]$	$P\bar{1}$	12.173(2)	72.48(3)		H_2O	2.103(4)	N,N	80.2(2,2)[d]	
(colourless)	2	13.387(3)	70.93(3)		N	2.220(5,10)	O,N	92.1(2,3.6)	
$[Zn(C_{23}H_{25}N_3O_2)\cdot(NO_3)]\cdot$	*or*	17.12(4)		ZnO_3N_3	$(NO_3)O$	2.109(14)	O,O	74.7(4)	204
NO_3	$Pna2_1$	12.13(7)			O	2.412(14,25)		134.9(4,2.0)	
(colourless)	4	11.41(8)			N	2.092(13,1)	N,N	82.1(4)[d],	
								118.4(4)	
								148.0(4)	
							O,N	68.7(4)[d]	
								76.7(4,3.9)[d]	
								102.9(4,15.6)	
								142.8(4)	
$[Zn(sc)_2Cl_2$	*m*	5.13(1)		$ZnO_2N_2Cl_2$	O	2.06(1)	O,N	79.9(4)[d]	361
(colourless)	$P2_1/c$	7.13(1)	109.7(1)		N	2.07(1)	O,Cl	92.5(3)	
	2	13.26(1)			Cl	2.594(4)	N,Cl	90.8(3)	

[a]Where more than one chemically equivalent distance or angle is present, the mean vlaue is tabulated. The first number in parenthesis is e.s.d., the second is a maximum deviation from the mean value. [b]The chemical identity of coordinated atom (ligand) is specified in these columns. [c]Four-membered metallocyclic ring. [d]Five-membered metallocyclic ring. [e]Six-membered metallocyclic ring. [f]There are two crystallographically independent molecules.

In the series of monodentate ligands, the mean Zn-L bond distance increases in the order: 2.100Å (OL) < 2.185Å (NL) < 2.562Å (Cl); in the series of bidentate ligands the order is: 2.150Å (NL) < 2.174Å (OL) < 2.523Å (SL).

The effects of electronic as well as steric hindrance of the coordinated atoms can be seen in the opening of the L-Zn-L bond angles of the respective metallocycles. For the four-membered metallocyclic rings, the L-Zn-L intraligand angles range from 52 to 61° for L = O donor atoms, 66° for L = N plus S donor atoms and 70.8° when L = S donor atoms. This reflects the difference in covalent radii of O(0.73Å), N(0.75Å) and S(1.02Å). For the five-membered metallocyclic rings, the L-Zn-L angles range from 78.7 to 81.5° for L = O donors, and from 73 to 86° when L = N donors. In the series of five-membered metallocycles, the N-Zn-N angles range from 73 to 80° (mean 77°) when L = N donors with unsaturation (for example phenanthroline, 2,2'-bipyridine, etc.), and from 82 to 86° (mean 83.5°) when the N donor is saturated. In the series of chelate ligands forming six-membered metallocycles, the L-Zn-L intra-ligand angles range from 84 to 88° (mean 86.5°) for L = O donors, from 88.5 to 92.3° (mean 90.5°) for L = O plus N donors), and from 90.6 to 96.2° (mean 93.2°) when L = N donors. This clearly reflects the covalent radii of L.

An example[314] occurs in two isomeric forms which differ mostly by degree of distortion involving both Zn-L distances and L-Zn-L angles. Two crystallographically independent molecules, differing by degree of distortion have been found to be present in one crystal in three cases.[311,316,360]

In general, the mean Zn-L bond distance increases with coordination number and covalent radius of the coordinated atom. Comparison of the four-coordinate, five-coordinate and six-coordinate distances gives: 1.993, 2.094 and 2.100Å (OL, 0.73Å) < 2.047, 2.076 and 2.185Å (NL, 0.75Å) < 2.247, 2.278 and 2.523Å (Cl, 0.99Å). In the series of bidentate ligands, no such tendency can be seen, and the mean Zn-L bond distance increases in the order: 2.066, 2.130 and 2.150Å (NL) < 2.246, 2.005 and 2.174Å (OL) < 2.371, 2.322 and 2.523Å (SL).

3.4 *Coordination Numbers Seven and Eight*

The crystallographic and structural data for these compounds are listed in Table 4. Of the three idealized geometries for seven coordination, pentagonal bipyramidal, capped octahedral and capped trigonal biprismatic, only the first is found in zinc(II) chemistry. The structure of colourless $[Zn(bdda)(H_2O)_3]\cdot 3\frac{1}{2}H_2O$ is shown in Figure 1 as a representative example.[363] The geometry of the crystal is a distorted pentagonal bipyramid with two water molecules in axial positions. The pentagonal plane is formed by the four oxygen atoms of the macrocyclic benzene-1, 2-dioxydiacetate and the oxygen of a water molecule. There are twelve examples[154,362,364–371] in which the zinc(II) atoms are in a distorted pentagonal bipyramidal environment.

Bond distances in the apical sites should usually be shorter than those of the equatorial sites because of steric crowding in the equatorial plane. From the data it can be seen that the mean Zn-OH_2 distances follow this expectation, being 2.089Å for the apical sites and 2.112Å for the equatorial sites. There are mono-, bi-, tetra- and pentadentate ligands. The monodentate ligands occupy apical positions, the mean Zn-L_{ap} distance increasing in the order: 2.081Å (NL) < 2.089Å (OH_2) < 2.236Å (OL) < 2.350Å (Cl).

Table 4 Crystallographic and structural data for seven- and eight-coordinated zinc(II) compounds[a].

COMPOUND (colour)	Crys. cl. Sp Grp Z	a[Å] b[Å] c[Å]	α[°] β[°] γ[°]	Chromo-phore	Zn-L [Å]		L-Zn-L [°]		Ref.
$[Zn(C_{10}H_{20}O_5)(H_2O)_2]\cdot(NO_3)_2$ (colourless)	*m* Pc 12	14.714(2) 14.066(2) 26.108(3)	96.83(1)	ZnO_7	O[b]eq H_2Oap	2.22 2.00	O,O[b]	not given	362
$[Zn(bdda)(H_2O)_3]\cdot 3.5H_2O$ (colourless)	*m* *C2/c* 8	29.343(2) 6.7294(9) 17.259(4)	109.17(5)	ZnO_7	Oeq	2.150(6,35) 2.475(7,6)	Oeq,Oeq	65.6(2,4.4)[c] 82.0(3,3) 143.8(3,19.2)	363
					H_2Oeq	2.112(7)	Oeq,Oap	90.0(3,9.7)	
					H_2Oap	2.038(8,16)	Oap,Oap	166.0(3)	
$[Zn(C_{14}H_{26}O_5)(bnf)(H_2O)]\cdot bnf\cdot tol$ (colourless)	*m* $P2_1/c$ 4	12.766(2) 39.083(5) 12.771(2)	116.44(1)	ZnO_7	Oeq bnfOap H_2Oap	2.214(9,115) 1.992(8) 2.065(7)	not given		364
$[Zn(C_{17}H_{23}N_5)(NCS)_2]\cdot 0.5C_2H_4Cl_2$ (not given)	*tr* *P*1 4	11.528(9) 7.942(9) 27.386(21)	93.06(12) 83.55(12) 115.08(15)	ZnN_7	not given		not given		365
$[Zn(pur)(NO_3)\cdot(H_2O)_2]\cdot 2H_2O$ (not given)	*m* *A2/a* 8	26.781(7) 7.192(2) 16.746(4)	101.42(2)	ZnO_6N	Oeq Neq	2.116(7,12) 2.229(7)	Oeq,Oeq	52.6(3)[d] 78.2(3,9), 130.7(3,1.0)[c] 151.2(2)	366
					NO_3Oeq	2.266(8) 2.511(8)	Oeq,Neq	75.7(3,6) 151.9(3,4)	
					H_2Oap	2.076(9,62)	Oeq,Oap	88.0(3,10.2)	
							Neq,Oap	96.4(3,8.6)	
							Oap,Oap	162,5(3)	
$[Zn(15\text{-crown-}5)(thf)\cdot Cl]\cdot[Zn_2Cl_6]$ (not given)	*m* $P2_1/a$ 4	21.150(6) 10.263(2) 10.149(2)	94.53(2)	ZnO_6Cl	Oeq thfOap Clap	2.199(16,74) 2.255(16) 2.266(6)	Oeq,Oeq	71.7(6,7)[c] 141.4(6,3.2)	154
							Oeq,Oap	83.4(6,4.8)	
							Oeq,Clap	96.6(5,4.5)	
							Oap,Clap	176.3(5)	
				$ZnCl_4$	see Table 5				
$[Zn(15\text{-crown-}5)\cdot(MeCN)_2]\cdot[Zn_2Cl_6]$ (not given)	*or* $A2_1am$ 4	15.268(5) 16.585(6) 11.632(5)		ZnO_5N_2	Oeq Nap	2.190(8,45) 2.081(13,12)	Oeq,Oeq	72.2(2,4)[c] 143.7(2,1.3)	154
							Oeq,Nap	90.0(4,5.6)	
							Nap,Nap	175.1(5)	
				$ZnCl_4$	see Table 5				

Table 4 *Continued*

COMPOUND (colour)	Crys. cl. Sp Grp Z	a[Å] b[Å] c[Å]	α[°] β[°] γ[°]	Chromo-phore		Zn-L [Å]	L-Zn-L [°]		Ref.
$[Zn(C_{19}H_{17}N_7)(H_2O)_2]\cdot(NO_3)_2$	*m*	14.132(4)		ZnN_5O_2	Neq	2.043(1,2)	not given		367
	Pn	9.226(4)	94.50(1)			2.298(1,20)			
(not given)	2	8.739(2)			H_2Oap	2.203(1,48)			
$[Zn(dappH_2)(H_2O)_2)]\cdot Cl_2$	*m*	7.887(2)		ZnN_5O_2	Neq	2.289(4,38)	Neq,Neq	69.0(2,1.0)[c]	368
(yellow)	$P2_1/n$	27.751(6)	105.23(2)					88.3(2)	
	4	10.377(3)			H_2Oap	2.104(4.1)	Neq,Oap	90.0(2,11.2)	
							Oap,Oap	176.5(2)	
$[Zn(daps)(H_2O)_2]\cdot(ClO_4)_2\cdot 1.5H_2O$	*m*	24.481(10)		ZnO_4N_3	Oeq	2.250(7,31)	Oeq,Oeq	78.2(3)	369
	C2/c	10.607(6)	90.12(3)		Neq	2.205(8,24)	Oeq,Neq	70.6(3,7)[c]	
(yellow)	8	20.182(9)			H_2Oap	2.100(7,13)	Neq,Neq	70.4(3,5)[c]	
							Oap,Oap	170.4(3)	
$[Zn(dapsc)(H_2O)\cdot Cl]\cdot Cl\cdot 2H_2O$	*m*	18.038(11)		ZnO_3N_3Cl	Oeq	2.196(9,12)	Oeq,Oeq	78.5(3)	370
	Ia	13.112(5)	100.28(4)		Neq	2.233(10,14)	Oeq,Neq	71.5(4,4)[c]	
(not given)	4	8.066(3)			H_2Oap	2.121(9)		144.9(4,5.3)	
					Clap	2.433(3)	Neq,Neq	69.4(4,5)[c]	
								138.7(4)	
							Oeq,Oap	85.0(4,1.9)	
							Oeq,Clap	92.2(3,1.1)	
							Neq,Oap	90.7(4,4.5)	
							Neq,Clap	91.4(3,4.8)	
							Oap,Clap	176.2(3)	
$[Zn(dnbo)(H_2O)_2]\cdot(ClO_4)_2\cdot MeCN$	*m*	8.068(2)		$ZnN_3O_2S_2$	Neq	2.108(2)	N,N	72.8(4,6)[c]	371
	$P2_1/c$	30.985(6)	99.03(3)			2.338(2,6)		144.9(4)	
(orange)	4	12.259(3)			Seq	2.710(5,43)	N,S	71.6(3,6)[c]	
					H_2Oap	2.097(10,36)		143.0(3,1.1)	
							S,S	71.9(1)[e]	
							N,O	90.7(4,6.5)	
							S,O	89.0(3,5.7)	
							O,O	176.7(4)	

Table 4 *Continued*

COMPOUND (colour)	Crys. cl. Sp Grp Z	a[Å] b[Å] c[Å]	α[°] β[°] γ[°]	Chromo-phore		Zn-L [Å]		L-Zn-L [°]	Ref.
$[Zn(dnbh)(ClO_4)_2$	*m*	11.385(2)		$ZnN_3O_2S_2$	Neq	2.057(6)	N,N	74.6(3,2)[c]	371
(orange)	$P2_1/c$	29.509(5)	126.62(2)			2.211(8,1)		148.9(2)	
	4	8.922(2)			Seq	2.574(4,59)			
					O_3ClOap	2.46(2,7)	N,S	74.1(2,1.6)[c]	
								136.4(2,6.4)	
							S,S	80.4(1)[c]	
							N,O	86.3(4,10.6)	
							S,O	77.0(2,2.3)	
								114.4(2,2.8)	
							O,O	165.6(3)	
$(AsPh_4)_2[Zn(NO_3)_4]$	*m*	23.355(5)		ZnO_8	O	2.059(8,13)	O,O	52.3(3,5)[d]	372
(not given)	*C*2/*c*	11.334(5)	107.5(1)			2.576(11,60)			
	4	18.588(5)							
$(PMePh_3)_2[Zn(B_{10}H_{12})_2]$	*m*	41.549(34)		ZnB_8	B	2.203(10,6)	B,B	42.3(4,7)	373
(yellow)	*C*2/*c*	10.071(8)	99.20(5)			2.446(11,25)		51.9(4,4)	
	8	23.500(18)						91.2(4,5)	

[a]Where more than one chemically equivalent distance or angle is present, the mean vlaue is tabulated. The first number in parenthesis is e.s.d., the second is a maximum deviation from the mean value. [b]The chemical identity of coordinated atom (ligand) is specified in these columns. [c]Five-membered metallocyclic ring. [d]Four-membered metallocyclic ring. [e]Six-membered metallocyclic ring.

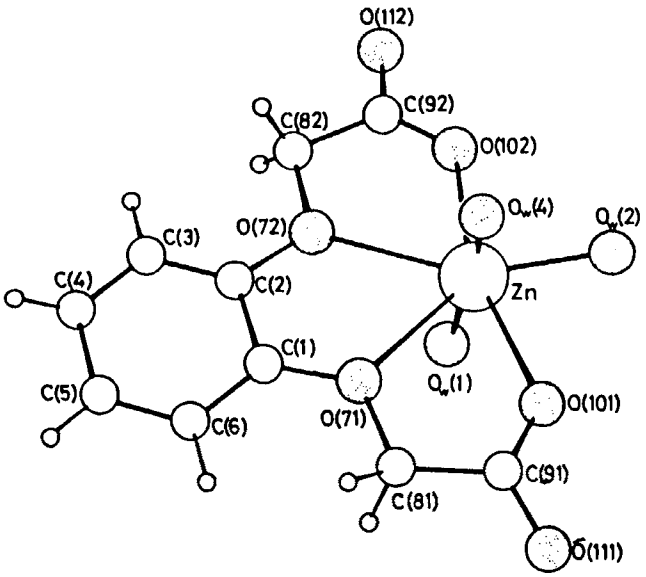

Figure 1 Structure of $[Zn(bdda)(H_2O)_3]\cdot 3.5\ H_2O$.[363]

One of the important characteristics for describing the pentagonal bipyramidal geometry is the ratio of the M-L_{ap} to M-L_{eq} distances. However, distortions are more definitively revealed by the bond angles L_{ap}-M-L_{ep}, L_{ap}-M-L_{ap} and L_{eq}-M-L_{eq} (*cis* and *trans*). In the ideal geometry, the values of these angles are 180°, 90°, 72° and 142°, respectively.[374,375] The first of these angles ranges from 162.5(3)° to 176.7(4)°, with an average value of 171.7°. The second differs from ideal by up to 25° (range 75° to 115°, and mean 90°). The third angle, within the pentagonal base, varies from ideal by about 20° (*cis*) to 17° (*trans*), confirming significant deviation from idealized geometry. Steric effects and constraints of multidentate ligands are primarily responsible for this observation.

There are only two examples[372,373] in which zinc(II) atoms are eight coordinated. The $[Zn(NO_3)_4]^{-2}$ anion[372] has approximately D_{2d} dodecahedral symmetry with two distinct Zn-O bond distances of 2.059Å (r_A) and 2.576Å (r_B). The difference of 0.52Å and r_A/r_B ratio of 0.80 indicates a considerable distortion but essentially dodecahedral character. In the other, yellow example, the difference is 0.24Å and the ratio is 0.41.[373]

4. DIMERIC ZINC(II) COMPOUNDS

Crystallographic and structural data for sixty dimeric zinc(II) compounds are gathered in Table 5. There are several types of bridging, the distorted edge-shared bi-tetrahedral structure being the most common (Table 5a). The most frequently found ligands are: a pair of oxygen donors;[313,376–385] a pair of nitrogen donors;[368,385–389] a pair of chlorine atoms[109,154,390–394] and a pair of sulphur donor ligands.[383,395–402]

Table 5 Crystallographic and structural data for binuclear zinc(II) compounds[a].

COMPOUND (colour)	Crys. cl. Sp. Grp Z	*a*[Å] *b*[Å] c[Å]	α[°] β[°] γ[°]	Chromo-phore	Zn-L [Å]	Zn-Zn[Å] Zn-L-Zn[°] μL-Zn-μL[°]	L-Zn-L [°]	Ref
A:								
$[Zn(\mu\text{-}OH)(C_9H_{21}N_3)]_2 \cdot (ClO_4)_2$	*m*	8.703(2)		ZnN_3O_2	N[b] 2.155(4,56)	3.024(1)	N,N[b] 83.1(2,1.9)[c]	313
	$P2_1/n$	8.325(2)	90.96(3)		μHO 1.972(4,15)	100.2(2)	N,O 104.1(2,9.1)	
(colourless)	2	20.470(4)				79.8(2)	165.2(2,2.8)	
$[Zn(\mu\text{-}OH)\{C(SiPhMe_2)_3\}]_2$	*m*	25.877(7)		ZnO_2C	μHO 1.899(9)	not given	O,C 138.9(3)	376
(not given)	*C*2/*c*	14.596(3)	94.56(3)		C 1.953(7)	102.3(3)	143.5(3)	
	4	13.990(4)				77.5(3)		
$(NEt_4)_2[Zn(\mu\text{-}MeC_6H_4O)Cl_2]_2$	*m*	11.564(2)		ZnO_2Cl_2	μO 1.993(3,6)	3.057(1)	Cl,Cl 115.4(1)	377
(not given)	?	11.011(2)	92.75(2)		Cl 2.218(1,1)	100.2(1)	O,Cl 130.2(3,1.5)	
	2	14.539(3)				79.8(1)		
$[Zn\{\mu\text{-}O(Me)CC(H)N(Bu^t)(Et)\cdot(Et)\}_2$	*tr*	7.57(1)	102.6(1)	ZnO_2NC	μO 2.07(1,5)	3.069(3)	O,N 82.8(5)[c]	378
	$P\bar{1}$	8.82(2)	91.8(1)		N 2.21(2)	95.8(5)	114.3(6)	
(colourless)	1	11.14(1)	114.4(2)		Et C 1.99(2)	84.2(5)	O,C 121.3(7,9.3)	
							N,C 124.9(7)	
$[Zn(Mesal)_2]_2$	*tr*	9.48	99.45	ZnO_3N_2	O 1.965(3)	3.222(1)	O,N 92.3(2,9)	379
(yellow)	$P\bar{1}$	10.53	92.58		μO 2.045(3,51)	103.9(2)	μO,N 84.7(2)[c]	
	1	8.45	117.58		N 2.058(5,7)	76.1(2)	110.6(2,14.9)	
							μO,O 99.2,172.5(2)	
							N,N 121.8(2)	
$[Zn(\mu\text{-}mpp)Cl]_2$	*tr*	9.194(1)	114.40(2)	ZnO_2	μO 2.051(2,22)	3.245(1)	N,N 85.60(9)	380
(colourless)	$P\bar{1}$	10.040(1)	115.93(2)	N_2Cl	N 2.154(3,29)	104.62(8)	N,O 91.0(1,1.7)[d]	
	1	10.316(2)	89.16(2)		Cl 2.2403(11)	75.38(8)	147.7(1,2.9)	
							N,Cl 102.4(1,8)	
							O,Cl 109.7(1,2.4)	
$[Zn(\mu\text{-}H_2NNHCONH_2)Cl_2]_2$	*tr*	6.7450(9)	61.44(1)	ZnO_2	μO 2.045(2)	not given	O,Cl 120.4(1,2.1)	381
(not given)	$P\bar{1}$	7.190(1)	64.77(1)	Cl_2N	2.262(2)	not given	Cl,Cl 117.3(1)	
	?	8.519(1)	65.21(1)		N 2.163(3)	not given		
					Cl 2.246(1,5)			
$Zn(C_5H_4NOS)_2$	*m*	8.405(1)		ZnO_3S_2	μO 2.152(6,30)	not given	O,μO 96.4(2)	382
(colourless)	$P2_1/c$	10.183(1)	97.24(1)		O 2.049(6)	T00.8(3)	174.0(2)	
	4	13.731(1)			S 2.308(3,1)	79.2(2)	O,S 85.4[c],95.2(2)	
							μO,S 82.4[c],111.9(2)	
							S,S 142.9(1)	

Table 5 *Continued*

COMPOUND (colour)	Crys. cl. Sp. Grp Z	*a*[Å] *b*[Å] c[Å]	α[°] β[°] γ[°]	Chromo-phore	Zn-L [Å]	Zn-Zn[Å] Zn-L-Zn[°] μL-Zn-μL[°]	L-Zn-L [°]	Ref
$[Zn(C_5H_4NOS)_2]\cdot CHCl_3$	*tr*	11.664(3)	67.05(2)	ZnO_3S_2	μO 2.139(7,47)	not given	O,μO 95.8(3)	382
(colourless)	$P\bar{1}$	12.120(3)	74.82(2)		O 2.050(7)	98.9(3)	177.0(3)	
	2	7.892(1)	113.18(2)		S 2.313(4,3)	81.1(3)	O,S 84.8[c],99.0(2)	
							μO,S 81.9[c],106.3(2)	
							S,S 141.7(1)	
$[Zn\{\mu\text{-}O(2,6\text{-}Pr^i_2C_6H_3)\}\cdot$	*or*	8.797(6)		ZnO_2C	μO 1.950(10,25)	not given	O,C 136.7(6,5)	383
$\{C(SiMe_3)\}]_2$	$P2_12_12_1$	19.016(17)			C 1.923(17)	100.3(4,5)	143.5(6,1)	
(colourless)	4	22.437(18)				79.8(4,6)		
$[Zn\{\mu\text{-}O(2,4,6\text{-}Bu^t_3\cdot C_6H_2)$	*m*	9.344(2)		ZnO_2C	μO 1.958(4)	not given	O,C 133.8(2)	383
$\{C(SiMe_3)\}]_2$	$P2_1/a$	18.872(4)	92.38(3)		2.021(4)	98.4(2)	144.4(2)	
(colourless)	2	13.056(5)			C 1.948(6)	81.6(2)		
$K_2[Zn(\mu\text{-}OBu^t)(Et)_2]_2$	*tr*	8.365(2)	73.56(2)	ZnO_2C_2	μO 2.094(4,4)	not given	not given	384
(colourless)	$P\bar{1}$	8.383(2)	105.18(2)		C 2.056(7,2)	100.4(3)		
	1	9.316(2)	114.51(2)			79.56(2)		
$[Zn\{\mu\text{-}OCR(CH_2)R\cdot CHRC(O)R\}$		not given		ZnO_3N	not given			385
$\{N(SiMe_3)_2\}]$								
(not given)								
$[Zn(C_5H_{13}N_2)H]_2$	*m*	6.372(3)		ZnN_3H	μN 2.061(11,1)	2.86	N,μN 84.1(4)[c]	386
(colourless)	$P2_1/c$	11.317(5)	111.75(8)		N 2.186(11)	88.0(4)	110.6(5)	
	2	11.977(5)			H not given	92.0(4)		
by neutron diffr.	*m*	6.284		ZnN_3H	μN 2.090(26,62)	2.86	N,μN 81.7(9)[c]	
(at 123K)	$P2_1/c$	11.298	111.75		N 2.227(27)	87.7(10)	110.4(11)	
	2	11.796			H 1.618(6)	92.3(10)	N,H 109.4(23)	
							μN,H 127.7(3,4.2)	
$[Zn(dapp)]\cdot CHCl_3\cdot H_2O$	*m*	18.842(7)		ZnN_6	N 2.041(10,23)	3.503(2)	N,N 78.2(4,5)[c]	368
(red)	*C*2/*c*	11.072(5)	94.93(3)		μN 2.49(1,10)	89.3(3)	110.2(4,6.6)	
	8	22.893(5)				89.9(3)	163.9(4)	
							N,μN 72.8(4,1.4)[c]	
							91.9(4,9.8)	
							149.9(4,1.0)	

Table 5 *Continued*

COMPOUND (colour)	Crys. cl. Sp. Grp Z	*a*[Å] *b*[Å] c[Å]	α[°] β[°] γ[°]	Chromo-phore	Zn-L [Å]	Zn-Zn[Å] Zn-L-Zn[°] μL-Zn-μL[°]	L-Zn-L [°]	Ref
$[Zn(dapth)]_2$	*m*	20.780(3)		ZnN_4O_2	N 2.012(6,8)	3.551(2)	N,N 162.2(6)	387
(yellow)	*C2/c*	17.162(2)	48.85(1)		μN 2.578(6,21)	87.1	N,μN 70.3(3,1)[c]	
	4	15.173(1)			O 2.017(7,9)	92.9(5)	97.2(5,1.0)	
							N,O 79.2(5,1)[c]	
							110.8(5,6)	
							μN,O 83.8(3,2.4)[c]	
							148.6(6,9)	
							O,O 114.4(5)	
$[Zn(\mu\text{-}NPh_2(Me)]_2$	*or*	7.57(2)		ZnN_2C	μN 2.072(9,10)	not given	N,C 134.6(6,7)	388
(not given)	$P2_12_12_1$	14.95(3)			MeC 1.948(18,19)	89.3(3,1)		
	4	20.43(4)				90.7(3,1)		
$Zn_2(C_{20}H_{28}N_4)(Et)_2$	*or*	16.98(2)		ZnN_3C	N 2.126(6,4)	not given	N,N 74.3(2,1)[c]	389
(colourless)	Pbca	17.76(1)			μN 2.085(6,16)	82.5(2,4)	83.6(2,1)[c]	
	8	17.63(1)			EtC 1.978(8,4)	97.5	96.0(2,0)	
							N,C 129.2(3,9.8)	
$(Et_3NCH_2Ph)_2[Zn_2Cl_6]$	*m*	15.188(4)		$ZnCl_4$	Cl 2.220(3)	not given	Cl,μCl 114.1(1)	109
(not given)	*B2/m*	13.402(3)	121.87(5)		μCl 2.351(5)	not given		
	4	11.482(2)						
$(Ph_3PCH_2Ph)_2[Zn_2Cl_6]$	*tr*	15.461(4)	97.0(1)	$ZnCl_4$	Cl 2.208(3,10)	not given	Cl,Cl 118.5(1,5)	109
(white)	$P\bar{1}$	11.005(3)	90.4(1)		μCl 2.339(2,7)	85.3	Cl,μCl 110.6(1,3.7)	
	4	14.837(3)	100.6(1)			94.7(1,4)		
$[Zn_2Cl_6]\cdot[Zn(15\text{-crown-}5)$	*or*	15.268(5)		$ZnCl_4$	Cl 2.209(4,3)	not given	Cl,Cl 118.3(1)	154
$(MeCN)_2]\cdot MeCN$	$A2_1am$	16.505(6)			μCl 2.365(4,1)	86.1	Cl,μCl 110.5(2,1.9)	
(colourless)	4	11.633(5)				93.9(1)		
				ZnO_5N_2	see Table 4			
$[Zn_2Cl_6]\cdot[Zn(15\text{-crown-}5)$	*m*	21.150(6)		$ZnCl_4$	Cl 2.203(8,10)	not given	Cl,Cl 118.8(3)	154
$thf\cdot Cl]_2$	$P2_1/a$	10.263(2)	94.53(2)		μCl 2.368(7,4)	86.4	Cl,μCl 110.4(3,1.2)	
(colourless)	4	10.149(2)				93.6(2)		
				ZnO_6Cl	see Table 4			
$[Zn_2Cl_6]\cdot[Zn(15\text{-crown-}5)$	*m*	9.548(4)		$ZnCl_4$	Cl 2.198(–,24)	not given	Cl,Cl 120.4	154
$(H_2O)Cl]_2$	$P2_1/b$	18.210(8)	99.10(3)		μCl 2.353(–,22)	85.0	Cl,μCl 109.6(–,3.3)	
(colourless)	2	11.705(4)				95.0		
$(PPh_4)_2[Zn_2Cl_6]$	*tr*	9.736(1)	107.93(2)	$ZnCl_4$	Cl 2.216(2,4)	not given	Cl,Cl 116.8(1)	390
(colourless)	$P\bar{1}$	9.826(2)	94.50(2)		μCl 2.365(2,5)	88.4	Cl,μCl 111.3(1,1.2)	
	1	12.967(3)	100.91(2)			91.6(1)		

Table 5 *Continued*

COMPOUND (colour)	Crys. cl. Sp. Grp Z	*a*[Å] *b*[Å] c[Å]	α[°] β[°] γ[°]	Chromo-phore	Zn-L [Å]	Zn-Zn[Å] Zn-L-Zn[°] μL-Zn-μL[°]	L-Zn-L [°]	Ref
$\{(Et_2O)(\mu\text{-}H)\}_2\cdot[Zn_2Cl_6]$	*tr*	8.422(3)	62.30(3)	$ZnCl_4$	not given			391
(not given)	$P\bar{1}$	10.212(5)	87.83(3)					
(at 203K)	1	10.466(5)	72.17(3)					
$[Zn_2Cl_6]\cdot[V_2Cl_3(thf)_6]_2$	*tr*	11.485(4)	71.07(2)	$ZnCl_4$	Cl 2.211(1,0)	3.251(1)	Cl,Cl 116.31(4)	392
(not given)	$P\bar{1}$	15.312(2)	99.10(2)		μCl 2.355(1,6)	87.3	Cl,μCl 111.4(1,3.2)	
	2	10.786(2)	104.41(2)			92.70(4)		
$[Zn_2Cl_6]\cdot[V_2Cl_3(thf)_6]_2$	*tr*	11.444(2)	109.09(1)	$ZnCl_4$	Cl 2.217(1,2)	3.257(1)	Cl,Cl 116.51(3)	393
(bright blue)	$P\bar{1}$	15.241(4)	98.61(1)		μCl 2.357(1,6)	87.4	Cl,μCl 111.3(1,3.6)	
	1	10.771(3)	75.66(1)			92.61(3)		
$[Zn_2Cl_6]\cdot[cp_2Tidme]_2\cdot C_6H_6$	*m*	11.810(4)		$ZnCl_4$	Cl 2.175(2,24)	3.303(2)	Cl,Cl 113.0(1)	394
(blue)	$P2_1/n$	10.201(5)	93.20(2)		μCl 2.387(2,68)	87.5(1)	Cl,μCl 112.4(1,4.3)	
	4	17.284(7)				92.5(1)		
$[Zn(\mu\text{-}SCPh_3)\cdot\{C(SiMe_3)\}]_2$	*tr*	9.396(3)	113.88(3)	ZnS_2C	μS 2.399(1,18)	not given	S, C 103.5(1)	383
(colourless)	$P\bar{1}$	10.609(4)	94.15(3)		C 1.976(4)	83.2(1)	131.1(1,4.0)	
	1	11.765(4)	92.89(3)			96.8(1)		
$(NEt_4)_2[Zn_2(SEt)_6]$	*m*	10.986(2)		ZnS_4	S 2.300(1,4)	3.179(1)	S,S 98.1(1)	395
(colourless)	$P2_1/n$	10.436(2)	93.56(2)		μS 2.425(1,31)	81.9(1)	110.7(1,3.2)	
	2	18.116(4)				98.1(1)		
$\{(C_6H_{11})_2NH_2\}_2\cdot[Zn_2(SPh)_6]$	*m*	19.627(8)		ZnS_4	S 2.292(2,12)	3.220(1)	S,S 126.6(1,2.0)	396
(not given)	$P2_1/c$	15.055(8)	108.80(3)		μS 2.412(2,40)	83.7(1,5)		
(at 203K)	4	21.163(6)				95.8(1,3)		
$(PPh_4)_2[Zn_2(SPh)_6]$	*m*	13.379(2)		ZnS_4	S 2.298(1,5)	3.421(1)	S,S 111.2(1)	397
(colourless)	$P2_1/c$	13.654(2)	106.50(2)		μS 2.428(1,4)	89.3(1)	S,μS 113.5(1,8.9)	
	2	20.480(3)				90.7(1)		
$[Zn(SBu^t_3C_6H_2\text{-}2,4,6)_2]_2$	*tr*	10.333(5)	81.29(2)	ZnS_3	S 2.194(5,10)	3.473(5)	S,μS 127.1(1,6.3)	398
(colourless)	$P\bar{1}$	11.226(9)	86.12(2)		μS 2.281(5,4)	95.8(2,9)	147.7(1,6.6)	
	2	32.266(30)	86.07(2)		2.400(5,29)	84.0(2,6)		
$[Zn(S_2CNPr^i_2)_2]_2$	*m*	16.857(3)		ZnS_5	S 2.377(1,77)	3.545(1)	S,S 75.00(3)[e]	399
(not given)	$P2_1/a$	11.168(3)	111.8(2)		μS 2.377(1)	85.70(1)	126.4(1,10.0)	
	2	11.408(3)			2.825(1)	94.33(2)	S,μS 68.89(3)[e]	
							105.6(1,13.8)	
							155.31(2)	

Table 5 *Continued*

COMPOUND (colour)	Crys. cl. Sp. Grp Z	*a*[Å] *b*[Å] c[Å]	α[°] β[°] γ[°]	Chromo-phore		Zn-L [Å]	Zn-Zn[Å] Zn-L-Zn[°] μL-Zn-μL[°]		L-Zn-L [°]	Ref
$[Zn(S_2CNEt_2)_2]_2$	*m*	9.907		ZnS_5	S	2.372(3,71)	3.545(4)	S,S	75.8(2)[e]	400
(colourless)	$P2_1/c$	10.627	113.52		μS	2.383(3)	85.6		122.3(–,15.4)	
	4	16.591				2.815(2)	94.4	S,μS	79.6[e]	
									104.7(–,11.1)	
									160.0	
$[Zn(S_2CNEt)_2(Me)]_2$	*m*	6.776(1)		ZnS_3C	S	2.370(3)	not given	S,μS	74.3(2)[e]	401
(not given)	$P2_1/c$	10.341(4)	97.3(3)		μS	2.506(4,6)	87.1		97.2(1)	
	2	14.479(5)			MeC	1.958(8)	92.9(2)	S,C	137.8(3)	
								μS,C	121.2(4,5.6)	
$[Zn(C_{33}H_{27}NS_2)]_2 \cdot MeCN$	*or*	17.963(10)		ZnS_3N	S	2.268(4)	not given	S,S	110.1(1,11.0)	402
(not given)	Aba2	27.433(3)			μS	2.388(4,38)	83.0(1)	S,N	112.6(3,9.0)	
	4	11.469(4)			N	2.081(11)	97.0(1)			
B:										
$[Zn(\mu\text{-prop})(prop)\cdot(nic)_2]_2$	*m*	11.152(3)		ZnO_3N_2	O	2.072(3)	not given	O,O	92.7(2)	403
(colourless)	$P2_1/n$	14.716(4)	102.560(2)		O	2.050(8,10)			133.6(2,3.0)	
		12.816(3)			N	2.183(5,9)		N,N	173.8(2)	
								O,N	90.4(2,4.0)	
$[Zn(Bu^tCH_2CO_2)(thf)\cdot Br]_2$	*m*	10.322		ZnO_2CBr	O	2.01		O,C	111.0	404
(not given)	$P2_1/n$	12.357	112.65		C	2.03				
	2	11.654			thfO	2.07				
					Br	2.35				
$[Zn(aldtc)_2]_2$	*tr*	8.218(2)	77.70(5)	ZnS_5	S	2.385(3,83)	3.580(3)	S,S	71.6(1,3.5)[e]	405
(colourless)	$P\bar{1}$	9.462(6)	77.46(4)			2.846(3)			103.9(1,12.1)	
	2	12.942(9)	78.25(4)						146.1(1,10.5)	
$[Zn\{(CH_2)_6NCS_2\}_2]_2$	*m*	10.948(1)		ZnS_5	S	2.366(7,79)	not given	S,S	71.8(–,4.3)[e]	406
(colourless)	$P2_1/c$	10.479(2)	114.48(3)			2.957(7)			94.3(–,153.3)	
	4	17.409(2)								
$[Zn(Pr_2PS_2)_2]_2$	*tr*	8.409(5)	90.99(5)	ZnS_4	S	2.314(2,8)	not given	S,S	84.1-	407
(colourless)	$P\bar{1}$	9.771(6)	99.28(4)			2.412(2,66)			124.3(1)	
	1	13.451(7)	105.27(5)							
$[Zn(Et_2PS_2)_2]_2^{\S}$	*m*	10.67(2)		ZnS_4	S	2.337(9,35)	4.222(5)	S,S	86.2(3,2)[f]	408
(colourless)	$P2_1$	31.93(4)	126.7(3)			2.412(9,42)			113.9(3,10.9)	
	4	12.50(2)		ZnS_4	S	2.338(8,40)	4.281(5)	S,S	85.7(3,4)[f]	
						2.485(9,24)			113.0(3,11.7)	

Table 5 *Continued*

COMPOUND (colour)	Crys. cl. Sp. Grp Z	*a*[Å] *b*[Å] c[Å]	α[°] β[°] γ[°]	Chromo-phore		Zn-L [Å]	Zn-Zn[Å] Zn-L-Zn[°] μL-Zn-μL[°]	L-Zn-L [°]		Ref
C: UNIQUE STRUCTURES:										
$Zn_2(C_{58}H_{68}N_8)$	*tg*	12.837(1)		ZnN_4	N	1.973(4,3)		N,N	97.6(2,4)	409
(not given)	$P4_32_12$	—				1.992(4,1)			116.2(2,12.0)	
	4	26.498(2)								
Zn_2(pp)	*tr*	19.44(1)	100.95(5)	ZnN_4	N	not given		not given		410
(not given)	$P\bar{1}$	19.53(1)	104.38(4)							
	2	15.023(5)	129.54(3)							
[Zn(oefb)]$_2$	*tr*	20.317(3)	125.1(1)	ZnN_4	N	not given	3.37	not given		231[b]
(green)	*P*1	15.101(2)	95.48(2)							
	2	13.665(2)	96.83(2)							
[Zn(μ-tu)(tu)$_2$]$_2$·$(S_2O_3)_2$·	*m*	27.36(2)		ZnS_4	S	2.337(4,23)		not given		411
$2H_2O$	*C*2/*c*	6.88(1)	113.7(4)			2.344(4)				
(not given)	4	18.86(4)								
[Zn(μ-Et_2nia)$(NCS)_2$]$_2$	*tr*	10.387(6)	108.4(1)	ZnN_3O	N	2.006(5)		N,N	114.3(2,2.0)	412
(not given)	$P\bar{1}$	12.436(6)	117.2(1)		O	2.014(4)		N,O	104.0(2,1.8)	
	1	7.835(5)	97.8(1)		SCN	1.925(5,4)				
[Zn(dmbin)Cl_2]$_2$·$CHCl_3$	*tr*	15.3221(8)	104.314(4)	ZnN_2Cl_2	N	2.057(4,11)	4.530(1)	N,N	104.0(2,8)	413
(yellow)	$P\bar{1}$	11.8450(5)	93.837(4)		Cl	2.213(2,10)		Cl,Cl	113.4(1,4)	
	2	10.9590(5)	92.763(5)							
[Zn(MeCHCHCO$_2$)$_2$qu]$_2$	*m*	10.532(1)		ZnO_4N	O	2.043(2,29)	2.976	O,O	88.0(1,2.3)	414
(colourless)	$P2_1/n$	10.910(1)	99.10(1)		N	2.063(2)			158.8(1,1)	
	2	14.623(2)						O,N	100.5(1,4.8)	
[Zn_2([30]ancN$_{10}$)·	*tr*	15.615(3)	78.85(2)	ZnN_5	N	2.13(2,5)	6.40	N,N	82.3(9,1.5)[c]	415
(NCS)](ClO$_4$)$_3$	*P*1	13.678(3)	82.62(5)						114.8(9,15.8)	
(not given)	2	9.473(2)	79.53(5)						160.2(10)	
				ZnN_5	N	2.16(2,5)		N,N	80.7(9,3.8)[c]	
					SCN	1.98(3)			110.1(9,21.0)	
									156.0(11)	
[$Zn_2(C_6H_6N_4)_5$]·$(ClO_4)_4$·	*or*	19.743(6)		ZnN_5	Neq	2.025(5,23)		Neq,Neq	119.9(2,16.7)	252[b]
$3H_2O$	$P2_12_12_1$	19.684(6)			Nap	2.219(5,46)		Neq,Nap	90.4 (2,11.5)	
(yellow)	4	12.034(3)						Nap,Nap	168.7(2,4)	
[Zn_2((24)aneN_8)Cl_2]·	*tr*	7.601(7)	63.17(3)	ZnN_4Cl	Neq	2.153(9,12)		N,N	80.6(3,1.7)[c]	416
Cl·ClO_4·H_2O	$P\bar{1}$	14.079(5)	78.13(8)			2.221(9,25)			93.4(3,1.4)	
(not given)	2	15.429(7)	85.65(8)		Clap	2.235(4,2)			140.2(3,7.5)	
								N,Cl	109.1(3,4.4)	

Table 5 *Continued*

COMPOUND (colour)	Crys. cl. Sp.Grp Z	a[Å] b[Å] c[Å]	α[°] β[°] γ[°]	Chromo-phore		Zn-L [Å]	Zn-Zn[Å] Zn-L-Zn[°] μL-Zn-μL[°]		L-Zn-L [°]	Ref
$(NBu_4)[\{Zn(Me_2NCS_2)_2\}_2 \cdot (\mu\text{-}MeCO_2)]$ (colourless)	*or* Pbcn 4	12.081(10) 20.306(16) 19.099(12)		ZnS_4O	Seq Oap	2.459(3,17) 1.979(6)		S,S	72.7(1,2)[e] 101.5(1,8) 154.2(1,1.0)	417
								S,O	102.9(2,5.7)	
$[\{Zn(dpt)\}_2(\mu\text{-}C_2O_4)] \cdot (ClO_4)_2$ (colourless)	*or* $Pna2_1$ 4	13.38(2) 14.72(3) 13.30(3)		ZnN_3O_2	N O O	2.08(2,8) 2.01(1,1) 2.22(1,2)		N,N O,O N,O	94.2(8,32.)[d] 122.0,145.0(9) 79.2(7,1.5)[c] 99.4(8,18.3) 173.6(8,3.4)	418
$[Zn_2(\mu_3\text{-}OH)(\mu\text{-}2Clbenz)_3 \cdot (H_2O)_2]$ (colourless)	*m* $P2_1/c$ 4	12.779(4) 23.732(6) 14.749(6)	147.98(4)	ZnO_5	μ_3HO O H_2O	2.110(9) 1.998(9) 2.040(8,54)		O,O	100.0(4,16.8) 176.8(3)	419
				ZnO_6	μ_3HO O H_2O	2.126(9,13) 2.009(10,2) 2.184(9,83)		O,O	89.7(4,12.8) 170.5(3)	
$[Zn_2(\mu\text{-}OH)(C_{20}H_{15}N_2O_3)_2] \cdot PF_6 \cdot 0{,}5\ MeOH$ (colourless)	*or* Pncb 4	12.254(5) 18.066(8) 19.605(9)		ZnO_4N_2	μHO O N	1.915(12) 2.060(4,27) 2.310(4) 2.135(4,20)	not given 130.8(2)	O,O N,N O,N	91.4(1,7.0) 83.1(2)[c] 77.9(2,2)[c] 95.9(2,9.6) 166.2(2,4.5)	420
$[Zn(atp)(bpy)]_2 \cdot 4H_2O$ (colourless)	*m* $P2_1$ 2	11.105(3) 25.223(7) 10.539(3)	91.34(4)	ZnO_4N_2	O N	2.03(4,6) 2.39(3) 2.71(4) 2.14(4,6)	not given	O,O N,N O,N	76–168(1) 77(2,1)[c] 79–179(2)	421
$[Zn_2(\mu\text{-}OH)(\mu\text{-}MeCO_2)_2 \cdot (C_9H_{21}N_3)_2] \cdot ClO_4 \cdot H_2O$ (colourless)	*tg* $P4_12_12$ 4	10.90(1) — 27.86(1)		ZnO_3N_3	μHO O N	1.996(4) 2.082(5,2) 2.244(7,31)	3.311(2) 112.1(3)	O,O N,N O,N	95.1(2,1.6) 79.2(2,5)[c] 92.3(2,6.2) 168.5(2,5.8)	313
$[Zn_2(dtpb)Cl_3] \cdot Cl \cdot 3H_2O$ (not given)	*tr* $P\bar{1}$ 1	15.380(2) 14.181(5) 17.325(2)	93.13(2) 116.515(9) 95.61(2)	ZnN_3Cl_2	N Cl	2.03(1,1) 2.53(1) 2.317(4,35)		N,N Cl,Cl N,Cl	74.2(5,1)[c] 116.6(5) 96.9(2) 106.0(4,13.4)	422
				ZnN_5Cl	N Cl	2.13(1,1) 2.43(1,2) 2.282(5)		N,N N,Cl	75.1(4,1.2)[c] 90.4(4,6.2) 102.0(3,6.7)	

[a]Where more than one chemically equivalent distance or angle is present, the mean vlaue is tabulated. The first number in parenthesis is e.s.d., the second is a maximum deviation from the mean value. [b]The chemical identity of coordinated atom (ligand) is specified in these columns. [c]Five-membered metallocyclic ring. [d]Six-membered metallocyclic ring. [e]Four-membered metallocyclic ring. [f]There are two crystallographically independent molecules.

In the crystal structure of colourless $[Zn(C_5H_{13}N_2)H]_2$[386] the two bridging nitrogen donor ligands bring the zinc(II) atoms to within 2.86Å, with Zn-N-Zn angles of 88.0(4)°. This is the shortest Zn-Zn distance found in the dimeric species. A relationship is observed between the bridge angles and the covalent radii of the briding atoms. As the radius of the donor atom increases, the Zn-L-Zn angle closes and the μL-Zn-μL angle opens, for example: O-donor (0.73Å), 95.9–104.6° (mean 100.5°) and 75.4–84.2° (mean 79.5°) < N-donor (0.75Å), 82.5–89.3° (mean 87.2°) and 89.9–97.5° (mean 92.8°) < Cl-atom (0.99Å), 85–88.4° (mean 86.7°) and 91.6–95° (mean 93.3°) < S-donor (1.02Å), 81.9–89.3° and 90.7–98.1° (mean 95.0°). In the colourless derivative $[Zn(2,4,6\text{-}Bu^t{}_3C_6H_2S)_2]_2$[398] the mean value of the Zn-S-Zn bridge angles of 95.8° is by far the largest for complexes with two sulphur bridges. Since the Zn-Zn distance is quite large at 3.473(5)Å, one might have expected a smaller Zn-S-Zn angle.

In another six examples[403–408] two bidentate ligands act as three atom bridges (Table 5b). In colourless $[Zn(prop)_2(nia)_2]_2$,[403] two five-coordinate zinc(II) atoms are bridged by the two propionate anions in a syn-syn arrangement, and the remaining two $CH_3CH_2COO^-$ anions act as monodentate ligands to each zinc(II) atom. In another derivative[404] two tetrahedrally-coordinated zinc(II) atoms are held together by two Zn-C-C-O-Zn bridges. Five-coordinate zinc(II) atoms are found in another two examples[405–406] doubly bridged by two S-C-S groups. Finally, in the remaining two examples[407,408] (Table 5b). two S-P-S groups serve as a bridge between two tetrahedrally-coordinated atoms.

There are seventeen examples each of which have a unique structure (Table 5c). For example, $Zn_2(C_{58}H_{68}N_8)$[409] contains two distorted tetrahedral zinc(II) atoms where the tetrapyrrole chromophore displays a "ridge-tile" conformation with an interplanar angle between the two Z-configured pyrro-methene units of 88.8°. In triclinic $[Zn(\mu\text{-}Et_2nia)(NCS)_2]$[412] two tetrahedra are held together by N,H-diethylnicotinamide molecules acting as bridges through the pyridine N and amide O atoms. A yellow derivative[413] has a dimeric cyclic structure incorporating two zinc(II) atoms in a ten-membered ring with *quasi* two-fold symmetry leaving a central hole of approximately 3.2 by 2.9Å. A colourless complex[414] has two zinc(II) atoms bridged by four $MeCH{=}CHCOO^-$ anions in a syn-syn arrangement, bringing the zinc atoms within 2.976Å of each other. The structure of $[Zn(\mu\text{-}OH)(\mu\text{-}MeCO_2)_2(C_9H_{21}N_3)_2]\cdot ClO_4$[313] is shown in Figure 2. Both zinc atoms are in octahedral environments and are separated by 3.311(2)Å.

The data in Table 5 show the dimeric zinc(II) compounds to be mostly colourless, with a few examples of yellow (4), and one each of white, green and red. The coordination number of the zinc(II) atom ranges from three to six, with the frequency of occurrence in the order: three (6) < six (7) < four (32). The four-coordinate examples are tetrahedral with varying degrees of distortion. The ligands involved are uni- to pentadentate, with some examples of octa- and nonadentate ligands. The most common bridging ligand is an O-donor or a chlorine atom, and bridge distances increase in the order: 1.942Å (OH) < 1.976Å (LO) < 2.072Å (LN) < 2.360Å (Cl) < 2.410Å (LS), following the covalent radii of the donor atom.

In the tetrahedral series, the mean Zn-L(terminal) distance increases in the sequence: 1.618Å (H) < 1.996Å (LC) < 2.003Å (LN) < 2.070Å (LO) < 2.208Å (Cl) < 2.297Å (LS) < 2.35Å (Br). The mean Zn-L(bridge) distances are somewhat

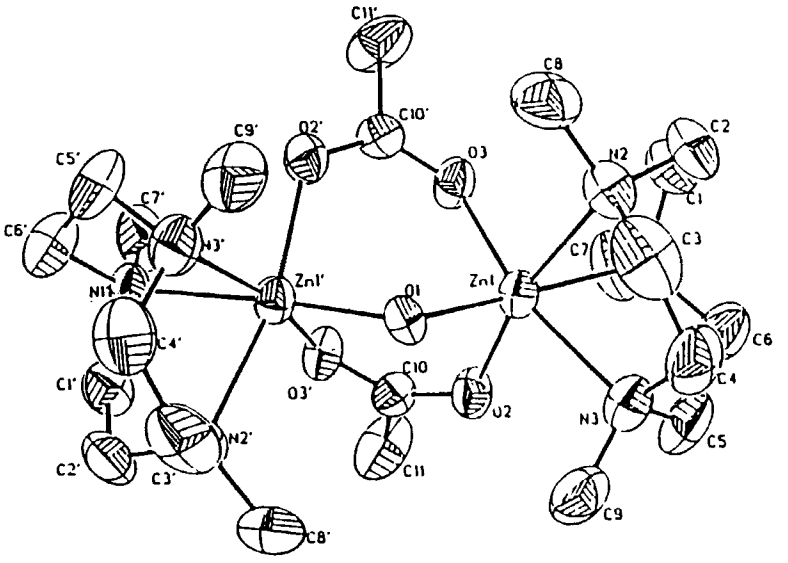

Figure 2 Structure of $[Zn(\mu\text{-}OH)(\mu\text{-}MeCO_2)_2(C_9H_{21}N_3)_2]\cdot ClO_4\cdot H_2O$.[313]

longer, for example: 2.360Å (μ-Cl) < 2.422Å (μ-LS). The shortest Zn-Zn distance in this series is 2.86Å.[386]

Two crystallographically independent molecules differing by degree of distortion have been found in one crystal.[408] Mixed chromophores occur in two examples, ZnO_5 plus ZnO_6[419] and ZnN_3Cl_3 plus ZnN_5Cl.[422]

5. OLIGOMERIC ZINC(II) COMPOUNDS

The crystallographic and structural data for these derivatives are found in Table 6. There are seven examples containing three zinc(II) atoms.[252b,383,423–425] The structures of $[Zn\{\mu\text{-}S(2,4,6\text{-}R_3C_6H_2)\}(Me_3SiCH_2)]_3$, where R is isopropyl or tert-butyl, are formed by trimerization *via* thiolate bridges of alkyl-zinc thiolate monomers.[383] The cores consist of six-membered rings that are comprised of alternating zinc and sulphur atoms, with each zinc atom having trigonal coordination.

The structure of colourless $[Zn_3\{\mu\text{-}O(2,6\text{-}Pr^i_2\ C_6H_3)\}_4(Me_3SiCH_2)_2]$[383] is comprised of an almost linear array of three zinc atoms (Zn-Zn-Zn = 175.7(1)°) that are bridged by four diisopropylphenoxy groups. The central zinc has a distorted tetrahedreal geometry, whereas the two terminal zinc atoms have a trigonal-planar coordination.

A white trimer[423] contains a central octahedrally coordinated zinc atom lying on the crystallographic two-fold axis, and two terminal pentacordinate zinc atoms. Each of the latter is connected to the central zinc by two shared oxygen atoms, one at an axial and the other at an equatorial position of the trigonal bipyramid.

Table 6 Crystallographic and structural data for oligonuclear zinc(II) compounds[a].

COMPOUND (colour)	Crys cl Sp.Grp *Z*	*a*[Å] *b*[Å] c[Å]	α[°] β[°] γ[°]	Chromo-phore		Zn-L [Å]	Zn-Zn[Å] Zn-L-Zn[°]		L-Zn-L [°]	Ref.
$[Zn\{\mu\text{-}S(2,4,6\text{-}Pr^i{}_3C_6H_2)\}\cdot$	*m*	18.135(8)		ZnS_2C	μS^b	2.308(2,19)	not given	S,S[b]	103.2(1,1.6)	383
$(Me_3SiCH_2)]_3$	$P2_1/c$	13.035(5)	96.34(3)		C	1.957(6,1)	130.3(1,1.5)	S,C	121.9(2,1.2)	
(colourless)	4	30.923							134.7(2,2.0)	
$[Zn\{\mu\text{-}S(2,4,6\text{-}Bu^t{}_3C_6H_2)\}\cdot$	*tr*	10.376(3)	103.04(3)	ZnS_2C	μS	2.329(2,38)	not given	S,S	99.8(1,4.3)	383
$(Me_3SiCH_2)]_3$	$P\bar{1}$	15.543(6)	97.35(2)		C	1.957(7,9)	140.6(1,6.7)	S,C	119.4(3,5.6)	
(colourless)	2	26.475(7)	101.15(1)						140.5(3,6.5)	
$[Zn_3\{\mu\text{-}O(2,6\text{-}Pr^i{}_2C_6H_3)\}_4\cdot$	*tr*	12.229(3)	103.97(2)	ZnO_2C	μO	1.959(8,10)	not given	O,O	80.2(1,1)	383
$(Me_3SiCH_2)_2]$	$P\bar{1}$	12.465(3)	90.23(2)	(× 2)	C	1.941(3,8)	100.1(1,1)	O,C	133.2(1,9)	
(colourless)	2	22.161(5)	106.93(2)						146.4(1,7)	
				ZnO_4	μO	1.969(2,16)		O,O	80.0(1,1)	
				(× 1)					111.8(1,2.6)	
									143.7(1,2.1)	
$[Zn(acac)_2]_3$	*m*	18.63(1)		ZnO_5	μO	2.075(2,21)	3.259(1)	μO,μO	75.7(1,1.3)	423
(white)	*C*2	8.437(5)	112.68(3)	(× 2)	O	1.994(3,23)		μO,O	103.1(1,23.6)	
	2	12.20(1)							176.2(1)	
								O,O	101.8(1,17.6)	
				ZnO_6	μO	2.138(2,30)		μO,μO	97.4(1,8.4)	
				(× 1)	O	2.015(3)			180.0(1)	
								μO,O	89.1(1,3.7)	
									159.4(1)	
								O,O	95.9(1,6.9)	
$Zn_3(crot)_6(qu)_2$	*m*	10.832(1)		ZnO_3N	μO	1.954(2)	3.3	μO,O	106.9(1,3.2)	424
(colourless)	$P2_1/c$	9.635(1)	100.29(1)	(× 2)	O	1.957(2,19)	104.2(1)	O,O	106.1(1)	
	2	20.784(2)			quN	2.027(2)		μO,N	130.4(1)	
								O,N	102.3(1,1.7)	
				ZnO_6	μO	2.177(2)		μO,O	90.1(1,1.2)	
				(× 1)	O	2.076(2,38)		O,O	91.9(1)	
$[Zn_3(C_4H_7N_3)_6(H_2O)_6]\cdot$	*trg*	14.450(2)		ZnO_3N_3	H_2O	2.10(2,0)	not given	O,O	84.7(1)	425
$(CF_3SO_3)_6$	*P*31*c*	—		(×2)	N	2.127(2,0)		N,N	92.0(1)	
(colourless)	2	19.812(7)						O,N	91.6(1,1.3)	
									174.6(1)	
				ZnN_6	N	2.165(2,O)		N,N	90.0(1,7)	
				(× 1)					179.0(1)	

Table 6 *Continued*

COMPOUND (colour)	Crys cl Sp.Grp Z	a[Å] b[Å] c[Å]	α[°] β[°] γ[°]	Chromo-phore		Zn-L [Å]	Zn-Zn[Å] Zn-L-Zn[°]		L-Zn-L [°]	Ref.
$[Zn_3(Me_4[15]aneN_4)_3 \cdot (MeOCO_2)_2] \cdot (ClO_4)_4$ (colourless)	*m* *C2/c* 4	37.189(5) 9.714(1) 16.749(2)	100.80(1)	ZnN_4O_2 (× 1)	N O	2.151(9,4) 2.213(7)	not given	N,N O,O N,O	92.7(3,1.0) not given 90.4(3,1.4)	252[b]
				ZnN_5O (× 2)	N O	2.087(17,20) 2.257(15) 2.034(6)		N,N N,O	77.3(6) 92.1(5,3.1) 133.4, 169.0(5) 102.8(4,20.5)	
$Zn_4(\mu_4\text{-}O)(\mu\text{-}MeCO_2)_6$ (colourless)	*C* *Fd3m* 8	16.45(3)		ZnO_4	μ_4O O	1.96 1.98	3.20		not given	426
$Zn_4(\mu_4\text{-}O)(\mu\text{-}MeCO_2)_6$ (colourless)	*C* *Fd3m* 8	16.402(1)		ZnO_4	μ_4O O	1.936(1) 1.946(4)	3.162(1)	O,O μ_4O,O	107.8(1) 111.1(1)	427
$[Zn_4(\mu_4\text{-}O)(dpt)_6] \cdot C_6H_6$ (colourless)	*tr* $P\bar{1}$ 2	12.272(9) 15.924(14) 19.563(16)	89.57(6) 105.13(7) 93.58(6)	ZnN_3O	N μ_4O	2.04(1) 1.91	3.11(-,8)		not given	428
$Zn_4(\mu_4\text{-}S)\{(EtO)_2PS_2\}_6$ (colourless)	*trg* *R3* 3	20.776(2) — 11.560(2)		ZnS_4	μ_4S S	2.266(6,2) 2.341(4,12)	3.701(2,4) 109.5(1,1)	μ_4S,S S,S	109.6(1.8) 110.6(1,1.2)	429
$Zn_4(\mu_4\text{-}S)(Me_2AsS_2)_6$ (not given)	*m* $P2_1/c$ 4	11.586(8) 33.08(2) 11.996(8)	117.39(1)	ZnS_4	μS S	not given not given		not given		430
$Zn_4(Et_2NCO_2)_6(Me)_2$ (colourless)	*tr* $P\bar{1}$ 1	11.747(1) 11.251(2) 10.422(1)	108.43(2) 76.48(2) 72.35(2)	ZnO_3C (× 2)	μO O MeC	2.064(6,69) 1.934(6) 1.945(8)	not given	μO,O μO,C O,C	95.2(3,3.2) 118.4(3,8.0) 126.5(3)	431
				ZnO_5 (× 2)	μO O	1.985(6) 2.591(7) 1.936(6,2)		μO,O O,O	56.3(3) 104.5(3,13.9) 162.5(3) 114.6(3,7.8)	
$[Zn\{\mu_3\text{-}O(1\text{-}ad)\} \cdot (Me_3SiCH_2)]_4$ (colourless)	*tg* $I4_1/a$ 4	21.307(10 — 13.365(8)		ZnO_3C	μ_3O C	2.089(2,41) 1.988(4)	not given 96.8(1,1.5)	O,O O,C	82.7(1,1.2) 122.7(1,1.4) 143.6(1)	383

Table 6 *Continued*

COMPOUND (colour)	Crys cl Sp.Grp Z	a[Å] b[Å] c[Å]	α[°] β[°] γ[°]	Chromo-phore	Zn-L [Å]	Zn-Zn[Å] Zn-L-Zn[°]	L-Zn-L [°]	Ref.
$[Zn(\mu_3\text{-}OMe)(Me)]_4$	*or*	7.481(15)		ZnO_3C	μ_3O 2.078(15.39)	3.086(5.9)	O,O 83.8(6,1.1)	432
(colourless)	$P2_12_12_1$	7.673(15)			MeC 1.946(33,16)	95.9(7,1.5)	O,C 129.4(9,6.3)	
	4	29.42(5)						
$[Zn(C_9H_9NO_2)]_4$	*tg*	15.004		ZnO_4N	μ_3O 1.995(3,4)	3.277(1,162)	O,O 77.3–	433
(not given)	$P4_2/n$	—			2.432(2)	102.1(1,7)	165.1(1)	
	8	8.125			O 1.938(3)		O,N 76.4–	
					N 2.007(3)		135.5	
$[Zn(C_6H_{14}NO)Cl]_4$	*tg*	15.539(12)		ZnO_2NCl	μO 1.940(4,22)	3.493(1)	O,O 107.7(2)	434
(colourless)	$P4_2/n$	—			N 2.086(5)	128.3(1)	O,N 87.0(2)	
	8	8.021(6)			Cl 2.206(2)		O,Cl 117.4(2,3.2)	
							N,Cl 112.1(2)	
$[(Et)Zn\{Me(Bu^t)N(H)\cdot$	*m*	20.063(1)		ZnO_2NC	μO 2.049(6,27)	not given	O,O 95.3(2,6)	435
$C{=}(MeO)CO\}]_4$	$P2_1/n$	12.875(1)	101.72(1)		N 2.211(8,20)	131.8(3,7)	O,N 81.9(3,2)[c]	
(colourless)	4	20.414(1)			EtC 1.978(9,5)		99.8(3,1.3)	
							O,C 119.5(3,4.9)	
							N,C 129.4(4,9)	
$[Zn(Pr^iOCS_2)_2]_4$	*tr*	10.915(3)	100.89(2)	ZnS_4	S 2.348(8,60)	not given	S,S 76.9(2,2)[d]	436
(not given)	$P\bar{1}$	13.167(4)	100.42(2)				114.7(3,8.1)	
	1	10.393(2)	101.33(7)					
$[Zn_2(\mu_3\text{-}OPh)(dmh)_2(Ph)]_2$	*m*	12.90(1)		ZnO_3C	μ_3O 2.04(1)	not given	O,O 82.0(5,5)	437
(colourless)	$P2_1/c$	11.92(1)	125.10(5)	(× 2)	μO 2.05(1,1)	96.9(6,1.2)	94.9(6)	
	2	23.21(1)			PhC 1.97(2)	101.7(6,1.1)	O,C 119.3(7)	
							131.2(9,2)	
				ZnO_6	μ_3O 2.19(2,2)		O,O 78.7–	
				(× 2)	μO 2.06(1,3)		170.1(2)	
					O 2.04(2,1)			
$[Zn(C_9H_6NO)_2]_4$	*tr*	11.858(1)	106.56(1)	ZnO_3N_2	μO 1.956(4)		O,O 79.2(2)	438
(pale yellow)	$P\bar{1}$	13.019(2)	109.00(1)	(× 2)	2.176(4)	102.1(2,5.5)	106.8,173.9(2)	
	1	10.834(1)	74.14(1)		O 2.020(4)		N,N 116.6(2)	
					N 2.051(5,4)		O,N 78.9-122.4(2)	
				ZnO_4N_2	μO 2.067(4,14)		O,O 77.0-174.5(2)	
				(× 2)	2.163(4)		N,N 90.2(2)	
					N 2.172(5,7)		O,N 77.2-153.8(2)	

Table 6 *Continued*

COMPOUND (colour)	Crys cl Sp.Grp Z	a[Å] b[Å] c[Å]	α[°] β[°] γ[°]	Chromo-phore	Zn-L [Å]		Zn-Zn[Å] Zn-L-Zn[°]	L-Zn-L [°]		Ref.
$[Zn_2(\mu\text{-}OH)(OH)\cdot(Bu_2^tP)_2]_2$	*tr*	12.072(3)	91.53(2)	ZnP_2O	μP	2.426(2,2)	not given	O,P	123.6(7)	439
(colourless)	$P\bar{1}$	15.812(3)	111.01(3)	(× 2)	HO	2.30(2)	105.6(2)			
	1	8.884(4)	110.73(2)							
				ZnO_2P_2	μHO	2.33(2,1)		O,O	108.6(4)	
				(× 2)	μP	2.369(4,1)	71.4(4)	P,P	147.2(2)	
								O,P	99.6(4,1.8)	
$(NMe_4)_2[(\mu\text{-}SPh)_6\cdot(ZnSPh)_2$	*tr*	12.377(2)	76.68(1)	ZnS_4	μS	2.364(3,20)	3.902(2,69)	μS,μS	107.1(1,5.2)	440
$(ZnCl)_2]$	$P\bar{1}$	16.592(3)	69.92(1)	(× 2)	S	2.266(3,0)	111.7(1,3.0)	μS,S	111.8(1,5.6)	
(not given)	2	16.967(3)	72.57(1)							
				ZnS_3Cl	μS	2.353(3,18)		μS,μS	108.9(1,12.2)	
					Cl	2.248(3,7)		μS,Cl	109.9(1,1.5)	
$[Zn(Me_3CS)(Me)]_5$	*m*	9.59(2)		ZnS_3C	μ_4S	2.514(8)	3.387-4.996(6)	S,S	78.4(3,2.1)	441
(colourless)	$P2_1/c$	39.04(6)	117.13(17)			2.712(8)	77.6(3,4.8)		91.7(3,7.3)	
	4	12.13(2)				2.982(8)	91.4(3,3.7)	S,C	111.5(8,5)	
					μ_3S	2.439(9,36)	128.9(3,3.2)		126.4(12,9.1)	
					μS	2.297(9,25)				
					MeC	2.01(4,9)				
$Zn_7(MeO)_8(Me)_6$	*tr*	10.08	115.4	ZnO_6	μ_3O	2.073(15,5)	3.089(4,84)	O,O	93-98	442
(not given)	$P\bar{1}$	8.76	117.3	(× 1)		2.170(17)	81-86			
	1	10.61	92.1							
				ZnO_3C	μ_3O	2.069(17,78)				
				(× 6)	MeC	1.953				
$Zn_7(MeO)_8(Et)_6$	*m*	11.276(3)		ZnO_6	μ_3O	2.06	not given	O,O	80.2	443
(colourless)	$P2_1/c$	15.741(3)	106.68(2)	(× 1)		2.13(3)	97.0			
	2	10.715(2)				2.18(3)				
				ZnO_3C	μ_3O	2.06		O,O	82.5	
				(× 6)	EtC	2.07				
$[Zn_7(O)_2(MeCO_2)_{10}\cdot(py)_2]$	*or*	16.598(3)		ZnO_6	μ_4O	1.95(2)	3.167(5,10.7)	O,O	87.4(7)	444
(colourless)	Pbca	14.682(4)		(× 1)	O	2.20(2,2)	109.4(9,6.4)		97.4(7,1)	
	4	19.111(9)								
				ZnO_4	μ_4O	1.95(2,1)		O,O	101.0(9,19.0)	
				(× 4)	O	1.95(2,3)				
				ZnO_3N	μ_4O	1.96(2)		O,O	100.8(9,7.1)	
				(× 2)	O	2.04(3,3)		O,N	97.4(9,4.5)	
					N	2.07(2)			147.3(9)	

Table 6 *Continued*

COMPOUND (colour)	Crys cl Sp.Grp Z	a[Å] b[Å] c[Å]	α[°] β[°] γ[°]	Chromo-phore	Zn-L [Å]		Zn-Zn[Å] Zn-L-Zn[°]	L-Zn-L [°]		Ref.
$[Zn_8(SPh)_{16}Cl]\cdot(Pr_3NH)$ (colourless)	*or* Pbcn 4	23.493(3) 29.726(4) 17.835(2)		ZnS_3Cl (× 4)	μS μ_4Cl	not given 2.36	3.85	not given		445
				ZnS_4 (× 4)	μS S	not given not given				
$Zn_8\{S(CH_2)_3NMe_2\}_{16}$ (not given) (at 120K)	*tg* $I\bar{4}$ 2	20.253(6) — 14.257(6)		ZnS_4 (× 4)	μS	2.346(2,20)	3.852(-,118) 110.3(1,4.1)	S,S	109.5(1,6.5)	446
				ZnS_3N (× 4)	μS S N	2.349(2,14) 2.256(2) 2.147(7)		S,S S,S S,N S,N	114.1(1) 116.3(1,3.9) 99.1(2,3.7) 107.5(2)	
$(NMe_4)_4[Zn_{10}(S)_4(SPh)_{16}]$ (colourless)	*tg* $P42_1c$[c] 2	19.783(4) — 16.871(5)		ZnS_4	μ_3S μS	2.303(4,3) 2.404(4,10)	105.4(2,3.8)	S,S	106.4(2,5.8) 122.3(2,1)	447
				ZnS_4	μS S	2.372(4,5) 2.283(5)		S,S	109.4(2,10.2)	

[a]Where more than one chemically equivalent distance or angle is present, the mean vlaue is tabulated. The first number in parenthesis is e.s.d., the second is a maximum deviation from the mean value. [b]The chemical identity of coordinated atom (ligand) is specified in these columns. [c]Five-membered metallocyclic ring. [d]Four-membered metallocyclic ring.

Octahedral coordination is also found in a colourless derivative[424] where the central zinc is linked to each terminal zinc atom by three crotonate bridges, two of which are syn-syn bidentate, and the other monodentate, bridging through only one oxygen atom. The structure of another colourless derivative[425] is shown in Figure 3. The central zinc(II) atom is octahedrally coordinated by six nitrogen atoms, while the terminal zinc(II) atoms are coordinated by three nitrogen atoms, and three oxygen atoms of water molecules.

In the series of trimeric derivatives, the zinc(II) atoms range from three to six coordinate, with the most common donor atom being oxygen. The mean Zn-L(bridge) distance increases with the covalent radius of the donor atom and with increasing coordination number. For three-coordinate complexes the values are: 1.959Å (LO) < 2.319Å (LS). The mean Zn-O(bridge) distances are: 1.959Å (three-) < 1.969Å (four-) < 2.075Å (five-) < 2.177Å (six-coordinate).

There are sixteen examples which contain four zinc(II) atoms. The colourless molecule $[Zn_4(\mu\text{-}O)(\mu\text{-}MeCO_2)_6]$ has a central oxygen atom which is tetrahedrally coordinated to all four zinc atoms.[426,427] Each zinc atom is tetrahedrally surrounded by four oxygen atoms, three from different bidentate acetato groups (Zn-O = 1.946(4)Å), the fourth being the central oxygen atom. A similar structure is present in three other examples.[428–430]

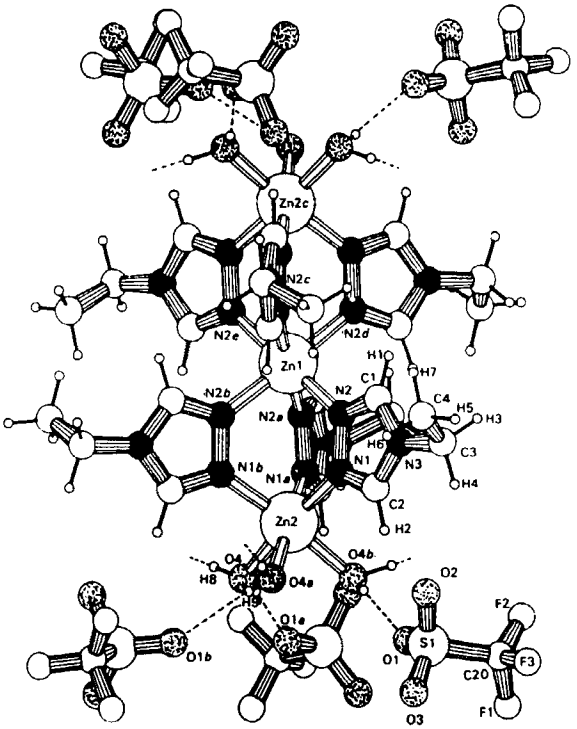

Figure 3 Structure of $[Zn_3(C_4H_7N_3)_6(H_2O)_6]$.[425]

The structure of colourless $Zn_4(Et_2NCO_2)_6(Me)_2$ is shown in Figure 4.[431] The zinc atoms lie in a plane and the unit is centrosymmetric with two independent zinc atoms. Four carbamate moieties bond along the edge of the Zn_4 parallelogram. Two further carbamate ligands bridge the diagonal of the parallelogram (Zn(1) to Zn(1')) above and below the plane of the zinc atoms. One of the oxygen atoms in each moiety bonds *via* a monoatomic bridge to Zn(2) and Zn(2'), the tetrahedral coordination being completed by a methyl group.

A distorted Zn_4O_4 cubane core is the main structural feature of three derivatives in Table 6.[383,432,433] In two of these[432,433] the zinc units of the tetramer are linked *via* zinc-oxygen-zinc bridges (average Zn-O-Zn angle of 128.3(1)°[434] and 131.8(3)°[435]), which forms a central eight-membered Zn_4O_4 ring. The four zinc(II) isopropylxanthate molecules in the unit cell of another tetramer[436] are linked together by -Zn-S-C-S-Zn- bridges to form a tetramer with a sixteen-membered ring. The coordination of the four sulphur atoms about each zinc atom creates a distorted tetrahedron. An eight membered Zn_4O_4 ring in $[Zn_2(\mu_3\text{-}OPh)(pac)_2Ph]_2$[437] is formed by alternating zinc and oxygen atoms. The ring is bridged twice by the oxygen atoms of the two PhZnOPH moieties. Two of the zinc atoms are four coordinate, the other two are six coordinate.

In pale yellow $[Zn(C_9H_6NO)_2]_4$[438] two of the monomeric units are connected by briding oxygen atoms. The crystallographically independent zinc atoms have different coordination geometries, *pseudo*-octahedral and distorted trigonal

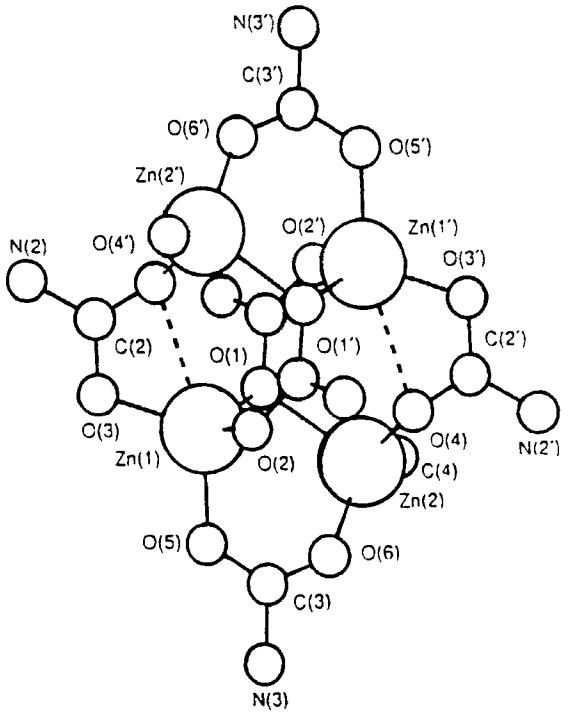

Figure 4 Structure of $Zn_4(Et_2NCO_2)_6(Me_2)$.[431]

bipyramidal. There is an example[439] in which the tetramer has an essentially planar Zn_4P_4 eight-membered ring. Two of the zinc atoms are four coordinate and bridge by two OH units lying above and below the plane of the ring. The remaining two zinc atoms each bear a terminal OH unit and are three coordinate. A final variation is the adamantane cage structure which is found in the derivative $(\mu\text{-SPh})_6(ZnSPh)_4]^{-2}$.[440]

The tetrameric derivatives have zinc(II) atoms from three to six coordinate, with the tetrahedral environment being most common. The mean Zn-L bond distance in the four coordinate derivatives increases with the covalent radius of the donor-atom, for example: 1.965Å (LO) < 2.227Å (Cl) < 2.266Å (LS); 1.963Å (bidentate LO) < 2.04Å (N + O) < 2.345Å (bidentate LS); and 1.935Å (μ_4-O) < 2.266Å (μ_4-S).

There is only one pentameric derivative, $[Zn(Me_3CS)(Me)]_5$ which is shown in Figure 5. The zinc(II) atoms lie near the corners of a square pyramid (apical position Zn(5)). The Zn-Zn distances range from 3.387 to 4.996(6)Å. Each zinc(II) atom is tetrahedrally coordinated by three S atoms and one C atom of a methyl group.

There are three heptameric examples, and the molecular structure of one of these[433] is shown in Figure 6. The centrosymmetric complex consists of two distorted enantiomorphic cubes which share a corner, the centre of symmetry. The zinc atoms occupy the corners of a tetrahedron, while the oxygen atoms are at the corners of a smaller interpenetrating tetrahedron. A similar bi-cubic structure has been found in $Zn_7(MeO)_8(Me)_6$.[442] In another case, seven zinc atoms are found in a heptameric centrosymmetric unit bridged by acetate groups.[444] In each of the two semi units a central oxygen atom is tetrahedrally surrounded by three zinc atoms,

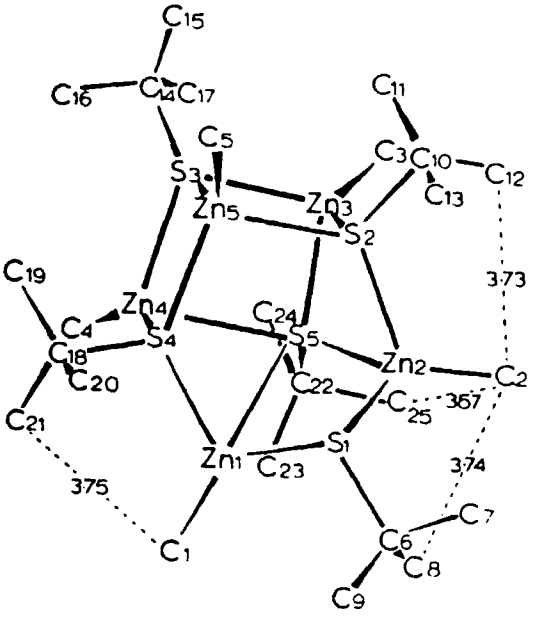

Figure 5 Structure of $[Zn(Me_3CS)(Me)]$.[441]

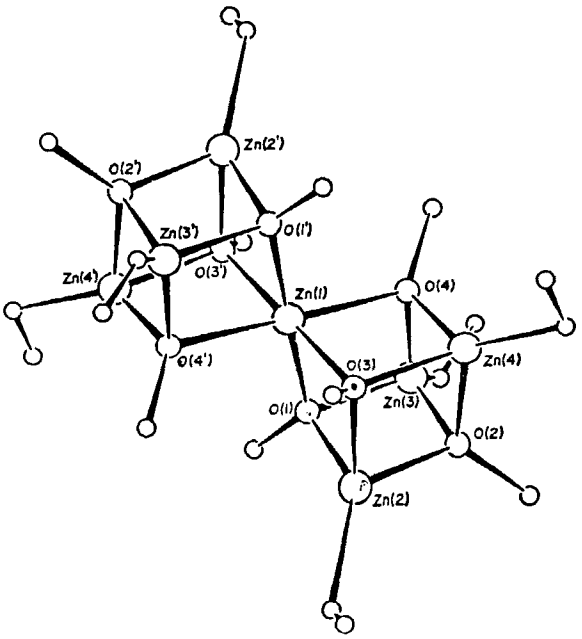

Figure 6 Structure of $Zn_7(MeO)_8(Et)_6$.[443]

and the seventh zinc atom occurs in a tetragonally compressed octahedral environment.

There are two examples containing eight zinc(II) atoms.[445,446] The structure of $[Zn_8(SPh)_{16}Cl]^{-}$[445] is shown in Figure 7. In the $[ClZn_4(\mu\text{-}SPh)_{12}(ZnSPh)_4]^{-}$ molecular cage the central chlorine atom is surrounded by a tetrahedron of zinc atoms, itself being enclosed by an icosahedron of bridging benzenethiolate ligands which link an outer array of ZnSPh groups. In $[Zn_8\{S(CH_2)_3NMe_2\}_{16}]$ there are central eight-membered Zn_4S_4 rings in which the four symmetry related zinc atoms lie almost in a plane (0.187Å deviation either side of the mean) and the sulphur atoms lie alternately on either side.[446] Each pair of adjacent zinc atoms of this central ring is further linked by a S-Zn-S fragment, giving rise to four six-membered Zn_3S_3 rings fused to the central ring. These six-membered rings have a boat conformation and lie alternately above and below the mean plane of the four central zinc atoms.

There is one example which contains ten zinc(II) atoms.[447] The molecular structure of the anion $[Zn_{10}(S)_4(SPh)_{16}]^{-4}$ has a $Zn_{10}S_4S_{16}$ core with the macro-tetrahedral environment of the well known zinc sulphide lattice. Six of the zinc atoms are arranged as an inner octahedron, with four of its faces capped by triply bridging sulphide ions. The other four faces of the inner octahedron are capped by $(\mu\text{-}SPh)_3ZnSPh$ groups, forming a large outer tetrahedron. Each inner zinc atom is thus coordinated by two triply bridging sulphide ions and two doubly bridging thiolate ligands. Each outer zinc atom is coordinated by three double bridging thiolate ligands and one terminal ligand.

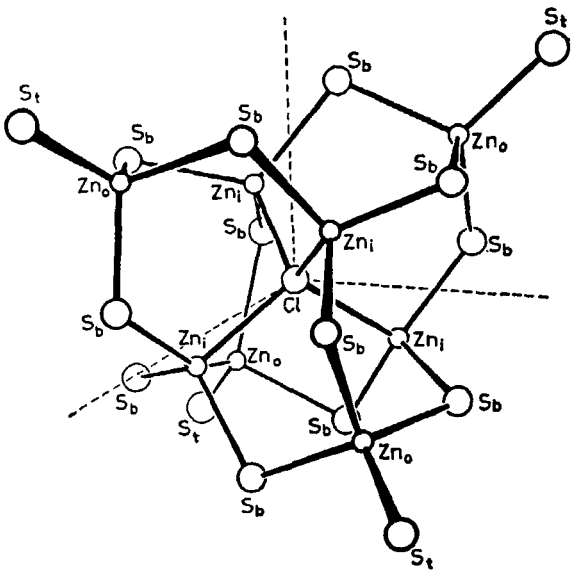

Figure 7 Structure of $[Zn_8(SPh)_{16}Cl]^-$.[445]

6. POLYMERIC ZINC(II) COMPOUNDS

The crystallographic and structural data for polymeric zinc(II) compounds are listed in Table 7. The variety in coordination geometry of these zinc(II) derivatives is indicated by the absence of any simple classification of structural types as found in the previous series. There are over seventy polymeric examples in which zinc(II) is found with four-, five- and six-coordinated geometries.

Almost thirty examples are found in which the zinc environment is essentially tetrahedral, but with varying degrees of distortion. The mean Zn-L bond distances found in these derivatives shows expected trends. The mean bond distance for the unidentate ligands increases with the covalent radius of the donor atom, for example: 2.045Å (LO) < 2.223Å (Cl) < 2.295Å (LS). A similar trend is found for the bidentate ligands: 1.947Å (LO) < 1.977Å (LN) < 2.359Å (LS).

There are fewer five-coordinate zinc(II) polymeric derivatives (Table 7), but both the limiting geometries of square pyramidal and trigonal bipyramidal occur with varying degrees of distortion. In one derivative, $Zn_2(\mu_3\text{-}OH)(\mu\text{-}ClC_6H_4COO)_3)(H_2O)_2$, the ligands around two independent types of zinc atom form a trigonal pyramid and an octahedron, respectively.[482]

There are over thirty examples in which zinc(II) atoms are six coordinate, mostly by O- and N-donors. The mean Zn-N bond distance increases with the number of donor atoms in the order: 2.094Å (mono-) < 2.146Å (bi) < 2.166Å (tri-) < 2.242Å (hexadentate). In the case of the Zn-O bond distance, the order is less systematic: 2.104Å (H_2O) < 2.120Å (tetra-) < 2.124Å (bidentate).

Overall, the data in Table 7 show the derivatives to be predominantly colourless, but there are a significant number of white, yellow, orange or purple examples.

Table 7 Crystallographic and structural data for polynuclear zinc(II) compounds[a].

COMPOUND (colour)	Crys. cl. Sp. Grp. Z	a[Å] b[Å] c[Å]	α[°] β[°] γ[°]	Chromo-phore	Zn-L [Å]	Zn-Zn[Å] Zn-L-Zn [°]	L-Zn-L [°]	Ref.
$Zn(MeCOO)_2$ (colourless)	*or* *Fdd*2 16	15.712(3) 15.558(2) 10.901(1)		ZnO_4	O[b] 1.934(12,21)		O,O[b] 109.5(5,7.3)	448
$Zn(MeCOO)_2$ (colourless)	*m* *C*2/*c* 8	30.237(2) 4.799(1) 9.260(1)	99.49(1)	ZnO_4	O 1.957(2,8)		O,O 109.5(1,8.7)	449
$Zn(EtCOO)_2$ (colourless)	*or* $Pna2_1$ 4	9.2862(9) 4.7937(4) 19.0871(12)		ZnO_4	O 1.956(6,21)		O,O 109.5(2,9.4)	450
$Zn(EtCOO)_2$ (colourless)	*m* $P2_1/c$ 4	19.144(4) 4.794(1) 9.286(2)	91.8(2)	ZnO_4	O 1.953(16,30)		O,O 109.5(7,10.1)	451
$Zn(PhCOO)_2$ (colourless)	*m* $P2_1/c$ 4	10.771(6) 13.076(6) 19.263(10)	95.19(4)	ZnO_4	O 1.95(1,3)		O,O 109.5(3,13.2)	452
$Zn(2\text{-}ClC_6H_4COO)_2$ (colourless)	*m* $P2_1/c$ 4	7.284(5) 10.480(4) 19.091(8)	95.59(5)	ZnO_4	O 1.928(5,16)		O,O 109.5(2,16.5)	453
$[Zn2\text{-}EtOC_6H_4COO)_2]\cdot H_2O$ (colourless)	*m* *Pc* 2	9.535(8) 11.610(10) 8.384(9)	92.9(1)	ZnO_4	O 2.039(9,51)		not given	454
$Zn_2(C_{10}H_{12}O_2S)_4$ (colourless)	*m* $P2_1$ 2	12.710(4) 13.760(2) 12.699(6)	95.44(5)	ZnO_4	O 1.958(5,39)	3.393(2)	O,O 109.5(3,12.5)	455
$Zn_2(crot)_4$ (colourless)	*or* $P2_12_12_1$ 4	9.1120(5) 13.3079(9) 16.9553(11)		ZnO_4	O 1.934(4,14)		O,O 109.5(2,12.6)	456
$Zn\{(EtO)_2PO_2\}_2$ (colourless)	*m* *C*2/*c* 4	22.176(6) 8.042(2) 9.088(3)	96.553(8)	ZnO_4	O 1.898(8,10)		O,O 109.5(6,5.2)	457
$Zn(BuPhPO_2)_2$ (colourless)	*m* $P2_1/c$ 8	10.16(2) 14.08(2) 32.59(4)	96.8(2)	ZnO_4	O 1.92(2,5)		O,O 109.5(8,3.8)	458
$Zn(BuPhPO_2)_2$ (colourless)	*or* $P2_12_12_1$ 3	10.18(2) 14.10(2) 32.43(3)		ZnO_4	O not given		not given	458

Table 7 *Continued*

COMPOUND (colour)	Crys. cl. Sp. Grp. *Z*	*a*[Å] *b*[Å] c[Å]	α[°] β[°] γ[°]	Chromo-phore		Zn-L [Å]	Zn-Zn[Å] Zn-L-Zn [°]	L-Zn-L [°]	Ref.
$[Zn(amph)_2]\cdot 4H_2O$ (colourless)	*or* $Pca2_1$ 4	10.001(2) 12.140(2) 10.281(2)		ZnO_4	O	1.936(2,43)		O,O 109.5(–,8.0)	459
$[Zn(daac)]\cdot 4H_2O$ (colourless)	*or* *C*222 4	17.84(4) 12.88(3) 6.63(2)		ZnO_4	O	1.96(2,1)		not given	460
$\{C(NH_2)_3\}_2\cdot[Zn(SO_4)_2]$ (colourless)	*tg* $I\bar{4}2d$ 4	9.515(1) — 14.351(3)		ZnO_4	O	1.944		O,O 102.74(4) 123.98(9)	461
$Zn(im)_2$ (colourless)	*tg* $I4_1cd$ 32	22.872 — 12.461		ZnN_4	N	1.83(–,4) 1.94(-,5)		N,N 109(–,7)	462
$[Zn(1,3\text{-pn})_2]Cl_2$ (white)	*m* $P2_1/c$ 8	12.833(4) 16.753(9) 13.010(4)	118.88(3)	ZnN_4	N	2.012(2,20)		N,N 109.5(1,6.5)	463
$Zn_2(bta)_4$ (colourless)	*m* $P2_1/c$ 4	10.030(2) 21.115(3) 19.912(8)	94.10(5)	ZnN_4	N	2.004(4,15)		N,N 109.5(2,9.8)	161
$Zn(C_5H_5)Me$ (colourless)	*or* Cmcm ?	8.944(2) 7.044(2) 9.476(2)		ZnC_4	MeC C	1.96(1,1) 2.70(1,48)	4.91	not given	464
$Zn\{(EtO)_2PS_2\}_2$ (colourless)	*m* $P2_1/a$ 4	12.084(3) 19.840(6) 8.463(5)	113.99(3)	ZnS_4	S	2.359(7,42)		S,S 85.9(2) 114.2(2,12.0)	465
$Zn_4(SPh)_7(MeOH)$ (colourless)	*or* $P2_12_12_1$ 4	16.529(2) 22.129(3) 14.241(2)		ZnS_4	S μS	2.265(4) 2.355(4,35)	3.776(3,222) 109.0(1,7.2)	S,S 115.4(1,19.7)	466
				ZnS_3O	μS O	2.320(4,23) 2.045(8)		S,S 113.4(1,1.6) S,O 105.2(3,2.8)	
$Zn(Bu_2PSO)_2$ (colourless)	*m* *Cc* 16	28.07(3) 15.48(2) 22.63(3)	92.9(3)	ZnO_3S	not given			not given	467
				ZnS_3O	not given			not given	
$Zn\{(CH_2NH)_2CS\}_2\cdot(S_2O_3)$ (colourless)	*or* $Pb2_1a$ 8	10.82(2) 28.86(5) 8.64(2)		ZnS_3O	S $(S_2O_3)S$ $(S_2O_3)O$	2.324(8,30) 2.309(7,4) 2.022(18,20)		S,S 111.2(3,11.2) S,O 105.1(3,4.4)	468

Table 7 *Continued*

COMPOUND (colour)	Crys. cl. Sp. Grp. *Z*	*a*[Å] *b*[Å] c[Å]	α[°] β[°] γ[°]	Chromo-phore		Zn-L [Å]	Zn-Zn[Å] Zn-L-Zn [°]	L-Zn-L [°]		Ref.
$Zn(cmomep)_2$	*tg*	11.261(6)		ZnO_2N_2	O	1.953(6)		O,O	104.8(2)	469
(colourless)	$P3_221$	—			N	2.003(4)		N,N	125.3(3)	
	3	27.050(22)						O,N	106.4(3,5.0)	
$Zn(dcmomep)_2$	*tg*	11.087(2)		ZnO_2N_2	O	1.97		not given		469
(colourless)	$P3_221$	—			N	2.00				
	3	26.553(6)								
$[Zn(p\text{-}NH_2C_6H_4COO)_2]\cdot$	*or*	7.623(1)		ZnO_2N_2	O	1.961(7,18)		O,O	113.0(3)	470
$1{,}5\ H_2O$	$P2_12_12_1$	11.189(3)			N	2.056(10,3)		N,N	116.8(3)	
(colourless)	4	16.873(5)						O,N	106.4(3,15.6)	
$[Zn(pur)_2]\cdot 4\ H_2O$	*m*	10.404(3)		ZnO_2N_2	O	2.15(2,5)		O,O	92.9(8,2.1)	471
(orange)	*C*2/*c*	25.355(7)	114.89(2)		N	2.11(3,4)		N,N	not given	
	4	9.695(3)						O,N	77.1(5,1.0)[c]	
									102.9(5,1.0)	
$Zn(C_6H_7N_5)Cl_2$	*m*	9.938(1)		ZnN_2Cl_2	N	2.054(2,14)		N,N	105.2(2)	472
(colourless)	$P2_1/n$	13.863(1)	94.93(1)		Cl	2.227(1,8)		Cl,Cl	118.3(2)	
	4	7.453(1)						N,Cl	106.7(2,2)	
$[Zn(mpp)Cl_2]\cdot O{,}5\ C_6H_6$	*m*	12.357(2)		ZnN_2Cl_2	N	2.022(12,9)		N,N	109.8(5)	380
	$P2_1/c$	12.400(2)	100.18(2)		Cl	2.219(4,28)		Cl,Cl	119.2(2)	
	4	14.957(2)						N,Cl	106.8(3,4.7)	
$Zn(C_3H_6O_3)$	*m*	8.110(1)		ZnO_5	μOeq	1.986(3,23)	3.116(1)	Oeq,Oeq	124.2(1,4.3)	473
(colourless)	$P2_1/c$	6.404(1)	93.44(1)		Oap	2.112(3)	97.2(4)	Oeq,Oap	89.2(1,9.4)	
	4	8.714(2)			μOap	2.142(3)	133.4(4)	Oap,Oap	175.4(1)	
$Zn(N_3)_2$(2-Mepy)	*tr*	6.028(2)	92.81(3)	ZnN_5	N_3Neq	2.004(31,7)	3.225(28)	Neq,Neq	119.9(1,10.9)	474
(colourless)	$P\bar{1}$	7.610(3)	101.08(2)		pyNeq	2.016(25)		Neq,Nap	89.9(1,12.5)	
	2	10.052(4)	94.64(3)		N_3Nap	2.189(30,44)		Nap,Nap	164.4(1)	
$Zn(N_3)_2$(4-Mepy)	*m*	10.855(2)		ZnN_5	N_3Neq	2.017(6,1)	3.032(2)	Neq,Neq	120.9(2,2.5)	475
(colourless)	*C*2/*c*	16.927(11)	113.47(5)		pyNeq	2.031(6)		Neq,Nap	90.0(2,11.8)	
	4	6.197(6)			N_3Nap	2.235(4,0)		Nap,Nap	170.6(2)	
Zn(ptpp)	*m*	10.8392(3)		ZnN_5	Neq	2.065(6,12)		N,N	88.9(2,7)	476
(purple)	$P2_1/c$	19.1240(9)	90.326(3)		Nap	2.234(6)				
	4	16.1580(6)								
$Zn(S_2O_4)$(py)	*or*	8.493(2)		ZnO_4N	Oeq	2.018(3,5)		not given		477
(white)	Pnma	11.095(3)			Nap	2.051(5)				
	4	9.161(2)								

Table 7 *Continued*

COMPOUND (colour)	Crys. cl. Sp. Grp. Z	a[Å] b[Å] c[Å]	α[°] β[°] γ[°]	Chromo-phore		Zn-L [Å]	Zn-Zn[Å] Zn-L-Zn [°]		L-Zn-L [°]	Ref.
$Zn_2(MeCOO)_3 \cdot$(etsc)	*m*	16.798(4)		ZnO_3N_2	O	1.995(6)	3.072(2)	O,O	91.6(3,11.6)	478
(yellow)	$P2_1/n$	10.692(4)			μO	2.032(6,78)	93.7(2,4.2)	N,N	77.3(3)[c]	
	4	11.760(5)	94.80(1)		N	2.064(7,32)		O,N	83.0–160.3(3)	
				ZnO_5	O	2.021(6.48)		O,O	75.3–172.9(223)	
					μO	1.961(6)				
						2.387(6)				
$Zn(NH_2NHCOO)_2$	*m*	6.87(1)		ZnO_3N_2	Oeq	2.044(9,14)		Oeq,Oeq	151.9(5)	479
(colourless)	*Pc*	5.08(1)	111.2(1)		Neq	2.079(14.2)		Neq,Neq	155.8(6)	
	2	9.10(1)			Oap	2.035(14)		Oeq,Neq	79.9(5)[c]	
									94.4(4,3.3)	
								Oeq,Oap	104.0(5,9.8)	
								Neq,Oap	101.5(5,3.6)	
$Zn(C_4H_8O_2)_2Cl_2$	*or*	9.368(5)		ZnO_3Cl_2	Oeq	2.06(2)		Oeq,Cl	112.7(6,4.1)	480
(colourless)	$P2_12_12_1$	17.91(3)			Cleq	2.17(1,2)		Cl,Cl	133.2(5)	
	4	7.239(5)			Oap	2.23(3)		Oeq,Oap	82.5(9,3.8)	
						2.65(3)		Cleq,Oap	91.2(7,8.4)	
								Oap,Oap	164.3(9)	
Zn(tc)(tcH)Cl	*or*	9.719(2)		ZnO_3NCl	Oeq	1.993(3,25)		Oeq,Oeq	109.8(1)	481
(not given)	$P2_12_12_1$	22.194(4)			Neq	2.071(4)		Oeq,N	123.2(1,9.7)	
	4	5.8537(5)			Oap	2.218(3)		Oeq,Oap	88.2(1,1)	
					Clap	2.369(1)		Oeq,Cl	99.4(1,7)	
								N,Oap	75.5(1)[c]	
								N,Cl	91.6(1)	
								Oap,Cl	166.64(9)	
$Zn_2(\mu_3\text{-}OH)(\mu\text{-}ClC_6H_4 \cdot$	*m*	12.779(4)		ZnO_5	Oeq	2.006(9,8)	3.19(–,13)	Oeq,Oeq	110.7(4,27.7)	482
$COO)_3(H_2O)_2$	$P2_1/c$	23.732(6)	147.98(4)		μ_3HOeq	1.986(8)	122.4(4)	Oeq,Oap	91.5(4,7.9)	
(colourless)	4	14.749(6)			Oap	2.110(9)		Oap,Oap	176.8(3)	
					μ_3HOap	2.093(8)				
				ZnO_6	O	2.067(9,7.1)		O,O	90.0(3,12.5)	
					μ_3HO	2.101(8)			170.5(3)	
					H_2O	2.266(9)				
$[Zn(NH_2C_6H_4SO_3)_2 \cdot$	*m*	7.474(8)		ZnO_6	O	not given		not given		483
$(H_2O)_2] \cdot 2H_2O$	$P2_1/n$	17.453(2)	116.420(8)		H_2O	not given				
(not given)	2	7.541(7)								

Table 7 *Continued*

COMPOUND (colour)	Crys. cl. Sp. Grp. *Z*	*a*[Å] *b*[Å] c[Å]	α[°] β[°] γ[°]	Chromo-phore	Zn-L [Å]	Zn-Zn[Å] Zn-L-Zn [°]	L-Zn-L [°]	Ref.
$Zn(HCOO)_2(H_2O)_2$ (colourless)	*m* $P2_1/c$ 4	8.685(2) 7.160(3) 9.323(5)	97.58(8)	ZnO_6	O 2.106(3,39)		not given	484
				ZnO_6	O 2.110(4,56) H_2O 2.103(3)			
$[Zn(C_8H_8O_5)_2(H_2O)_2]\cdot 2H_2O$ (colourless)	*m* $P2_1/a$ 4	10.907(5) 8.502(3) 11.083(4)	107.15(3)	ZnO_6	O not given H_2O not given		not given	485
$Zn(1,2\text{-ethanediol})_2\cdot(H_2O)_2]\cdot SO_4$ (colourless)	*m* *C2/c* 4	7.089(1) 15.662(3) 10.240(1)	104.44(1)	ZnO_6	O 2.076(2) 2.157(2) H_2O 2.042(2)		O,O 90.0(1,4.0) 175.2(1)	486
$Zn(mal)(H_2O)_2$ (colourless)	*m* *c2/m* 4	12.58(5) 7.41(5) 7.23(5)	119.0(5)	ZnO_6	O 2.08(1,6) H_2O 2.11(1,5)	5.18(3)	O,O 90.0(5,3.0)	487
$[Zn(mal)(H_2O)_2]\cdot H_2O$ (colourless)	*m* $P2_1$ 2	8.901(7) 9.087(6) 5.803(3)	113.20(3)	ZnO_6	O 2.065(5,19) 2.153(5) H_2O 2.111(6,35)		O,O 77.1(2)[c] 91.3(2,10.1) 170.7(2,7.4)	488
$Zn(C_7H_8O_5)(H_2O)$ (colourless)	*m* $P2_1/c$ 2	9.307(3) 5.194(2) 10.850(5)	99.74(1)	ZnO_6	O 2.179(2) 2.213(2) H_2O 2.020(2)		O,O 58.9(1)[d] 88.4–168.0(2)	489
$[Zn(iprcit)(H_2O)_2]\cdot 2H_2O$ (colourless)	*m* $P2_1/c$ 4	9.934(4) 29.692(3) 8.941(4)	144.73(2)	ZnO_6	O 2.053(3,3) 2.148(3,10) H_2O 2.066(3,29)		O,O 80.3(1,3.3)[c] 93.2(1,3.8)	490
$Zn(C_3H_4O_6P)_2(H_2O)_2$ (colourless)	*tr* $P\bar{1}$ 1	5.184(3) 5.341(5) 12.124(9)	84.69(7) 86.72(6) 86.36(7)	ZnO_6	O 2.033(2) 2.065(2) H_2O 2.180(2)	5.341(5)	O,O 90.0(1,2.4)	491
$Zn(C_4O_4)(H_2O)_4$ (colourless)	*m* *Cc* 4	9.012(2) 13.336(3) 6.746(2)	99.33(2)	ZnO_6	O 2.073(6,1) H_2O 2.103(8,49)		not given	492
$[Zn(C_4O_4)(H_2O)_2]_3\cdot MeCOOH\cdot H_2O$ (colourless)	*c* *Pn3n* 8	16.260(4)		ZnO_6	O 2.114(4,18) H_2O 2.053(3)		O,O 90.0(–,6.7) 178.3(–,1.1)	493

Table 7 *Continued*

COMPOUND (colour)	Crys. cl. Sp. Grp. *Z*	*a*[Å] *b*[Å] c[Å]	α[°] β[°] γ[°]	Chromo-phore	Zn-L [Å]		Zn-Zn[Å] Zn-L-Zn [°]	L-Zn-L [°]	Ref.
$Zn_5(piba)_{10}(H_2O)_2$	*m*	37.78(1)		ZnO_5	O	1.975(16,22)	3.289(4)	O,O 73.2(6)[c]	494
(colourless)	*C2/c*	13.596(5)	103.90(2)			2.382(15)	105.7(6)	84.1–130.4(6)	
	4	20.708(6)			μO	1.927(17)		172.1(5)	
						2.082(14)			
				ZnO_6	O	1.981(13,8)		O,O 74.1(6,1.0)[c]	
						2.180(17,135)		93.2(6,11.2)	
					μO	2.045(15)		165.5(6,4.1)	
				ZnO_6	O	2.066(15)		O,O 93.8(6,3.8)	
					μO	2.125(16)			
					H_2O	2.112(15)			
$Zn(PhPO_3)(H_2O)$	*or*	5.634(2)		ZnO_6	O	2.05(2,1)		O,O 64.5(5)	495
(colourless)	$Pmn2_1$	14.339(5)				2.28(1)		103.4(6)	
	2	4.833(1)			H_2O	2.12(2)			
$Zn(trz)_2(NCS)_2$	*or*	7.897(2)		ZnN_6	N	2.142(2)		N,N 90.0(1,4.5)	496
(colourless)	Pbcn	9.816(1)				2.210(2)		177.1(1,5)	
	4	16.224(6)			SCN	2.094(3)			
Zn(bndpp)	*tr*	11.707(2)	102.60(3)	ZnN_6	N	2.052(4,2)		N,N 90.0(2)	497
(not given)	$P\bar{1}$	12.774(5)	101.31(2)			2.432(5)			
	1	9.521(2)	100.29(2)						
$Zn\{C(CN)_3\}_2$	*or*	7.466(2)		ZnN_6	N	2.120(2)		N,N 90.0(1,5.6)	498
(not given)	Pmna	5.3171(5)				2.211(2)			
	2	10.482(2)							
$(NMe_4)[Zn_2(N_3)_5 \cdot H_2O]$	*m*	11.770(1)		ZnN_6	N	2.044(19)		not given	499
	$P2_1/n$	6.553(1)	96.9(2)			2.115(16,8)			
(colourless)	4	20.789(10)				2.227(17,55)			
				ZnN_5O	N	2.107(17,6)			
						2.236(17,25)			
					H_2O	2.140(16)			
$Zn(asp)(H_2O)_3$	*or*	9.38(6)		ZnO_5N	O	2.14(-,6)		not given	500
(colourless)	$P2_12_12_1$	7.92(0)			N	2.00			
	?	11.53(2)			H_2O	2.15(-,6)			
$Zn(asp)(H_2O)_3$	*or*	9.443(5)		ZnO_5N	O	2.151(2,91)		not given	501
(colourless)	$P2_12_12_1$	7.862(4)			N	2.077(2)			
	4	11.696(6)			H_2O	2.140(3,34)			

Table 7 *Continued*

COMPOUND (colour)	Crys. cl. Sp. Grp. Z	a[Å] b[Å] c[Å]	α[°] β[°] γ[°]	Chromo-phore	Zn-L [Å]	Zn-Zn[Å] Zn-L-Zn [°]	L-Zn-L [°]	Ref.
$Zn(glut)(H_2O)_2$ (white)	*or* $P2_12_12_1$ 4	11.190(2) 10.463(1) 7.220(2)		ZnO_5N	O 2.061(–,45) 2.576 N 2.103		O,O 95.6(–,10.5) 159.5 O,N 79.4[c] 96.5(–,5.9) 162.6	502
$[Zn(2,3\text{-pyd})(H_2O)_2]\cdot H_2O$ (colourless)	*tr* $P\bar{1}$ 2	6.488(3) 9.873(7) 9.999(6)	130.11(4) 87.10(4) 100.32(5)	ZnO_5N	O 2.113(6,53) N 2.145(4) H_2O 2.090(7,2)		O,O 90.3(2,9.2) 168.9(2,3.3) O,N 79.5(2)[c] 93.6(2,2.3) 170.4(2)	503
$[Zn_2(cdta)(H_2O)_5]\cdot 4H_2O$ (not given)	*m* $P2_1/n$ 4	9.702(2) 11.757(2) 20.980(5)	95.61(2)	ZnO_6	O 2.095(8,15) H_2O 2.074(9,11) 2.169(9,21)		O,O 90.0(4,5.2) 173.2(4,2.2)	504
				ZnO_4N_2	O 2.135(9,66) N 2.187(11,18) H_2O 2.026(8)		O,O 91.4(4,11.1) N,N 82.9(4)[c] O,N 76.9(4,2.1)[c] 105.1(4,14.4) 152.9(4,4.3)	
$[Zn_2(cdta)(H_2O)_4]\cdot 2H_2O$ (not given)	*or* $Pbc2_1$ 4	10.977(2) 11.073(2) 17.436(2)		ZnO_6	O 2.064(7,6) H_2O 2.123(7,56)		O,O 90.0(3,9.2) 171.2(3,2.2)	505
				ZnO_4N_2	O 2.067(7,72) N 2.157(7,20)		O,O 95.7(3,20.2) N,N 84.3(3)[c] O,N 81.2(3,1.6)[c] 95.7(3) 159.9(3,1.6)	
$[Zn(HCOO)(HCONH_2)_2]\cdot$ (HCOO) (colourless)	*or* *Pnn2* 4	11.617(10) 8.717(3) 8.289(2)		ZnO_4N_2	O 2.117(4,15) O 2.059(4,18) N 2.111(6,20)		O,O 90.3(2,2.5) 178.1(2) N,N 84.9(2) O,N 90.6(2,9.8) 172.3(2,2.1)	506
$[Zn(ox)(2\text{-Meim})_2]\cdot O,5H_2O$ (not given)	*m* $P2_1/c$ 8	13.767(3) 11.959(5) 16.993(6)	103.34(4)	ZnO_4N_2	O 2.157(4,63) N 2.074(5,9)		O,O 76.6(1,1.0)[c] 87.9(2,3.6) 160.8(2,1.4) N,N 97.4(2.7) O,N 94.2(2,13.1) 166.3(2,3.5)	507

Table 7 *Continued*

COMPOUND (colour)	Crys. cl. Sp. Grp. Z	a[Å] b[Å] c[Å]	α[°] β[°] γ[°]	Chromo-phore	Zn-L [Å]	Zn-ZnÅ] Zn-L-Zn [°]	L-Zn-L [°]	Ref.
$Zn(L\text{-}ser)_2$	*m*	9.542(9)		ZnO_3N_2	O 2.058(5,97)		O,O 96.2(2,3.6)	508
(colourless)	$P2_1$	8.818(3)	96.72(6)		N 2.061(5,4)		167.7(2)	
	2	5.666(3)					N,N 112.2(2)	
							O,N 79.8(2,2)[c]	
							97.0(2,7.1),143.3(2)	
$Zn(L\text{-}asp)_2$	*m*	12.323(1)		ZnO_4N_2	O 2.094(4,8)		O,O 90.0(2,4.4)	509
(colourless)	$P2_1$	5.027(2)	99.12(4)		2.278(4)		174.0(2,9)	
	2	9.702(2)			2.481(5)		N,N 171.1(2)	
					N 2.082(5,11)		O,N 81.0(2,1)[c]	
							92.9(2,8.6)	
$Zn(L\text{-}met)_2$	*m*	15.731(5)		ZnO_4N_2	O 2.054(6,5)		O,O 79.9(2)[c]	510
(colourless)	$P2_1$	5.119(2)	107.96(2)		2.240(6)		93.4(2,2.3)	
	2	9.437(4)			2.729(7)		172.4(2,4)	
					N 2.058(8,6)		N,N 163.3(3)	
							O,N 81.8(3,1.1)[c]	
							97.7(3,4.4)	
$[Zn(glyglygly)(H_2O)_2]\cdot 2H_2O\cdot 0.5SO_4$	*or*	25.86(3)		ZnO_5N	O 1.964(4)		O,O 93.1(–,6.9)	511
	*P*bcn	8.011(6)			2.186(3)		174.1	
(colourless)	8	13.59(1)			2.782(4)		O,N 79.5[c]	
					N 2.034(4)		95.7,121.3	
					H_2O 2.052(4,73)		138.4	
$[Zn\{CH_2(NH_2NHCO)_2\}\cdot(H_2O)_2]\cdot SO_4\cdot H_2O$	*m*	11.63(2)		ZnO_4N_2	O 2.12(2,2)		O,O 89.9(1.0,2.8)	512
	$P2_1/b$	11.78(2)			N 2.24(2,3)		173.6(1.0)	
(colourless)	4	11.99(2)	130.5(5)		H_2O 2.08(2,8)		N,N 96.0(1,0)	
							O,N 76.4(1.0,6)[c]	
							92.8(1.0,3.1)	
							169.3(1.0,1.0)	
$[Zn([14]aneN_4)\cdot(CH_3OCO_2)]\cdot ClO_4$	*m*	12.128(2)		ZnN_4O_2	N 2.100(5,65)		N,N 84.4(2,7)[c]	252[b]
	$P2_1/n$	16.509(1)	95.36(1)		O 2.227(3)		94.3(2,3.4)	
(colourless)	4	9.793(1)			μO 2.143(3),2.685(3)		N,O 90.0(1,8.4)	
$[Zn(C_{10}H_{24}N_4)Cl]_2]\cdot[ZnCl_4]\cdot 2H_2O$	*tg*	17.950(5)		ZnN_4Cl_2	N 2.066(14)		N,N 84.1(7,1)[d]	513
	*I*42*d*	—			2.117(14)		96.0(7)	
(colourless)	4	10.907(2)			Cl 2.730(4)		177.2(5)	
							Cl,Cl 177.5(2)	
							N,Cl 90.0(4,4.8)	
				$ZnCl_4$	Cl 2.288(5,0)		Cl,Cl 109.5(2,1.3)	

[a]Where more than one chemically equivalent distance or angle is present, the mean vlaue is tabulated. The first number in parenthesis is e.s.d., the second is a maximum deviation from the mean value. [b]The chemical identity of coordinated atom (ligand) is specified in these columns. [c]Five-membered metallocyclic ring. [d]Three-membered metallocyclic ring.

There are three examples[448,449;450,451;458] which exist in isomeric forms differing mostly by degree of distortion.

7. CONCLUSIONS

This review presents almost six hundred structures of zinc(II) complexes. Although mostly colourless, many do have colour, which can be attributed to ligand absorptions or charge transfer bands. The latter is more common with electron withdrawing ligands.

The lowest coordination number observed is two, which is found with the organometallic derivatives. The highest coordination number is seven. More commonly, coordination numbers four to six are found in the order of frequency, five < six < four. The four-coordinate derivatives are mostly distorted tetrahedral, a few examples having a distorted square planar environment. Consideration of the nuclearity of the complexes (i.e. the number of zinc atoms) indicates a wide range between mononuclear and polynuclear.

Some zinc(II) compounds occur separately as distortion isomers involving distortions of both the Zn-L distances and L-Zn-L angles[51;59;97;138,139;176,177;185,186;263,264;314;448,449;450,451;458] Two crystallographically independent molecules of differing degrees of distortion have been found present in one crystal in several cases.[39,68,71,105,131,207,218,242,249,252,262,269,311,316,360,408] Such a coexistence is also common in the general class of distortion isomers.[220]

In general, the Zn-L distances increase with increasing coordination number and covalent radius of the respective donor atoms. Several correlations can be seen between the Zn-Zn distances, Zn-L-Zn bridge angles, the type of bridging and the nuclearity. These have been discussed separately in each section. The shortest Zn-Zn distance observed overall is 2.86Å.[386]

This review presents the first overview of structural data for zinc(II) compounds, and a related review on the biological effects of zinc(II) is currently in progress. Despite the increasing availability of data retrieval systems, the tracing of relevant material is not always a straightforward task. Much data is only available as supplementary material and some is obscured. The systematic analysis and correlation of structural data should serve to highlight both areas of interest and those requiring more investigation.

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References

1. M.F. Sunn, *Struct. Bonding,* **23,** 61 (1975).
2. M.N. Hughes, *Coord. Chem. Rev.,* **37,** 297 (1981); **45** 329 (1982); **52,** 1 (1983); **58,** 1 (1984);

D. Dakternieks, *ibid,* **62,**1 (1985); **78,** 125 (1987) and **98,** 279 (1989).
3. R.D. Ernst, J.W. Freeman, P.N. Swepston and D.R. Wilson, *J. Organomet. Chem.,* **402,** 17(1991).
4a. F.I. Aigbirhio, S.S. Al-Juaid, C. Eaborn, A. Habtermariam, P.B. Hitchcock and J.D. Smith, *J. Organometal. Chem.,* **405,** 149 (1991).
4b. A.D. Pajerski, G.L. BergStresser, M. Parvez and H.G. Richey, Jr., *J. Am. Chem. Soc.,* **110,** 4844 (1988).
5. S. Castillo, V. Herault and J.P. Declercq, *Acta Crystallogr.,* Sect. C, **43,** 1530 (1987).
6. N. Rodier, R. Ceolin, M. Plat and H. Zumbihl, *Acta Crystallogr.,* Sect. C, **46,** 324 (1990).
7. I. Potočňák, M. Dunaj-Jurčo and J. Černák, *Acta Crystallogr.,* Sect. C, **49,** 1496 (1993).
8. H.P. Klug, L.E. Alexander and G. Gardner Sumner, *Acta Crystallogr.,* **11,** 11 (1958).
9. C.J. Brown and J.F.P. Lewis, *Acta Crystallogr.,* Sect. C, **40,** 368 (1984).
10. D.L. Hughes and J.N. Wingfield, *J. Chem. Soc.,* Dalton Trans., 459 (1985).
11. L.J. Guggenberger, *Inorg. Chem.,* **8,** 2771 (1969).
12. C.A. Bear, K.A. Duggan and H.C. Freeman, *Acta Crystallogr.,* Sect. B, **31,** 2713 (1975).
13. Y. Kojima, K. Hirotsu, T. Yamashita and T. Miwa, *Bull. Chem. Soc. Jpn.,* **58,** 1894 (1985).
14. A.C. Skarpski and K.A. Woode, *Acta Crystallogr.,* Sect. B, **35,** 59 (1979).
15. N.C. Baenziger, S.L. Modak and C.L. Fox, Jr., *Acta Crystallogr.,* Sect. C, **39,** 1620 (1983).
16a. C.J. Brown, D.S. Cook and L. Sengier, *Acta Crystallogr.,* Sect. C, **41,** 718 (1985).
16b. I. Agrell, *Acta Chem. Scand.,* **24,** 1247 (1970).
17. K. Aoki, H. Yamazaki and A. Adeyemo, *Inorg. Chim. Acta,* **180,** 117 (1991).
18. M.R. Caira and L.R. Nassimbeni, *Cryst. Struct. Com.,* **5,** 309 (1976).
19. L.R. Groeneveld, G. Vos, S. Gorter and J.G. Haasnoot, *Acta Crystallogr.,* Sect. B, **38,** 2248 (1982).
20. A.L. Spek, *Cryst. Struct. Com.,* **11,** 1621 (1982).
21. L. Nassimbeni and A. Rodgers, *Acta Crystallogr.,* Sect. B, **30,** 1953 (1974).
22a. A.L. Spek, W.L. Driessen and W.G.R. Wiesmeijer, *Acta Crystallogr.,* Sect. C, **44,** 1567 (1988).
22b. W. Brandt, J. Wirbser, A.K. Powell and H. Vahrenkamp, *Z. Naturforsch* **46b,** 440 (1991).
23. R.H. Kretsinger, F.A. Cotton and R.F. Bryan, *Acta Crystallogr.,* **16,** 651 (1963).
24a. T.J. Kistenmacher, *Acta Crystallogr.,* Sect. B, **28,** 1302 (1972).
24b. M.M. Harding and S.J. Cole, *Acta Crystallogr.,* **16,** 643 (1963).
25. J.A. Kanters, A.L. Spek, R. Postma, G.C. van Stein and G. van Koten, *Acta Crystallogr.,* Sect. C, **39,** 999 (1983).
26. N. Masciocchi, M. Moret, A. Sironi, S. Bruni, F. Cariati, A. Pozzi, T. Manfredini, L. Menabue and A. Benedetti, *Inorg. Chim. Acta,* **159,** 173 (1989).
27. C.L. Hill and M.M. Williamson, *J. Chem. Soc.,* Chem. Commun., 1228 (1985); M.M. Williamson, C.M. Prosser-McCartha, S. Mukundan. Jr., and C.L. Hill, *Inorg. Chem.,* **27,** 1061 (1988).
28. U. Simonis, F.A. Walter, P.L. Lee, B.J. Hanquet, D.J. Meyerhoff and W.R. Scheidt, *J. Am. Chem. Soc.,* **109,** 2659 (1987).
29. W.R. Scheidt, J.J. Mondal, C.W. Eigenbrot, A. Adler, L.J. Radonovich and J.L. Hoard, *Inorg. Chem.,* **25,** 795 (1986).
30. W.R. Scheidt, M.E. Kastner and K. Hatano, *Inorg. Chem.,* **17,** 706 (1978).
31. A.J. Goldner, K.B. Nolan, D.C. Povey and L.R. Milgrom, *Acta Crystallogr.,* Sect. C, **44,** 1916 (1988).
32. D.R. Benson, R. Valentekovich, C.B. Knobler and F. Diederich, *Tetrahedron,* **47,** 2401 (1991).
33. W.R. Scheidt and W. Dow, *J. Am. Chem. Soc.,* **96,** 1101 (1974).
34. N.W. Alcock, A.C. Benniston, P. Moore, G.A. Pike and S.C. Rawle, *J. Chem. Soc.,* Chem. Commun., 706 (1991).
35a. T. Koike, E. Kimura, I. Natamura, Y. Hashimoto and M. Shiro, *J. Am. Chem. Soc.,* **114,** 7338 (1992).
35b. R. Benn, H. Grondey, H. Lehmkuhl, H. Nehl, K. Angermund and C. Krüger, *Angew. Chem.,* **99,** 1303 (1987).
36. B. Morosin and K. Emerson, *Acta Crystallogr.,* Sect. B, **32,** 294 (1976).
37. I.D. Williams, P.W. Brown and N.J. Taylor, *Acta Crystallogr.,* Sect. C, **48,** 259 (1992).
38a. J.R. Wiesner, R.C. Srivastava, C.H.L. Kennard, M. Di Vaira and E.C. Lingafelter, *Acta Crystallogr.,* **23,** 565 (1967).
38b. F.J. Zúñiga, G. Madariaga and J.M. Pérez-Mato, *Acta Crystallogr.,* Sect. B, **45,** 462 (1989).
39. F.J. Zúñiga and G. Chapnis, *Acta Crystallogr.,* Sect. B, **39,** 620 (1983).

40. F.J. Zúñiga and G. Chapnis, *Cryst. Struct. Com.*, **10,** 533 (1981).
41. M.L. Glowka and Z. Galdecki, *Polish J. Chem.*, **55,** 651 (1981).
42. B. Viossat, P. Khodadad and N. Rodier, *Bull. Soc. Chim. Fr.*, I-214 (1984).
43. A. Mostad and C. Romming, *Acta Chem. Scand.* **22,** 1259 (1968).
44. F.J. Zúñiga, M.J. Cabezudo, G. Madariaga, M.R. Presepich, M.R. Bond and R.D. Willett, *Acta Crystallogr.*, Sect. B, **47,** 337 (1991).
45. E. Deutsch, *J. Org. Chem.*, **37,** 3481 (1972).
46. G. Hänggi, H. Schmalle and E. Dubler, *Inorg. Chim. Acta,* **197,** 135 (1992).
47. W.S. Sheldrick, *Z. Naturforsch,* **37b,** 653 (1982).
48. M.C. Kerr, H.S. Preston, H.L. Ammon, J.E. Huhfey and J.M. Stewart, *J. Coord. Chem.*, **11,** 111 (1981).
49. W.G. Jackson, A.M. Sargeson, P.A. Tucker and A.D. Watson, *J. Am. Chem. Soc.*, **103,** 533 (1981).
50. A. Höhn, R.J. Gene, A.M. Sargeson and A.C. Willis, *J. Chem. Soc.*, Chem. Commun., 1644 (1989).
51. A.R. Gainsford, D.A. House and W.I. Robinson, *Inorg. Chim. Acta,* **5,** 595 (1971).
52. B.F. Anderson, J.D. Bell, A.R. Gainsford and D.A. House, *Inorg. Chim. Acta,* **30,** 59 (1978).
53. G. Bombieri, F. Benetollo, A. Del Pra, M.L. Tobe and D.A. House, *Inorg. Chim. Acta,* **50,** 89 (1981).
54. G. Bombieri, E. Forsellini, A. Del Pra and M.L. Tobe, *Inorg. Chim. Acta,* **51,** 177 (1981).
55. D.A. House, G. Hall, A.J. Matheson, W.T. Robinson, F.C. Ha and C.B. Knobler, *Inorg. Chim. Acta,* **39,** 257 (1980).
56. P.R. Treland, D.A. House and W.T. Robinson, *Inorg. Chim. Acta,* **4,** 137 (1970).
57. H.C. Freeman, L.C. Marzilli and I.E. Maxwell, *Inorg. Chem.*, **9,** 2408 (1970).
58. W.G. Jackson, G. M. McLaughlin, A.M. Sargeson and A.D. Watson, *J. Am. Chem. Soc.*, **105,** 2426 (1983).
59. D.A. Buckingham, J.D. Edwards and G.M. McLaughlin, *Inorg. Chem.*, **21,** 2770 (1982).
60. M. Kojima, K. Natabayashi, S. Ohba, S. Olimoto, Y. Saito and J. Fujita, *Bull. Chem. Soc. Jpn.*, **59,** 277 (1986).
61. D.A. Buckingham, C.R. Clark, B.M. Foxman, G.J. Gainsford, A.M. Sargeson, M. Wein and A. Zanella, *Inorg. Chem.*, **21,** 1986 (1982).
62. L.R. Gahan, T.W. Hambley, A.M. Sargeson and M.R. Snow, *Inorg. Chem.*, **21,** 2699 (1982).
63. J. Springborg, R.J. Gene, A.M. Sargeson, D. Taylor and M.R. Snow, *J. Chem. Soc.*, Chem. Commun., 647 (1978).
64. G.J. Gainsford, W.G. Jackson and A.M. Sargeson, *J. Chem. Soc.*, Chem. Commun., 875 (1981).
65. R.J. Gene, M.G. McCarthy, A.R. Sargeson, E. Horn and M.R. Snow, *J. Chem. Soc.*, Chem. Commun., 848 (1986).
66. A.R. Gainsford, G.J. Gainsford and D.A. House, *Cryst. Struct. Comm.*, **10,** 365 (1981).
67. G.J. Gainsford, D.A. House, W. Marty and P. Comba, *Cryst. Struct. Comm.*, **11,** 215 (1982).
68a. I. Sotofte, R. Gronback and S.E. Rasmusen, *Acta Crystallogr.*, Sect. B, **32,** 1692 (1976).
68b. E.K. Barefield, A. Bianchi, E.J. Billo, P.J. Conovlly, P. Paoletti, J.S. Summers and D. Van Derveer, *Inorg. Chem.*, **25,** 4197 (1986).
69. C.S. Gibbons and J. Trotter, *J. Chem. Soc. A,* 2659 (1971).
70. A. Bino, F.A. Cotton, Z. Dori, M. Shaia-Gottlieb and M. Kapon, *Inorg. Chem.*, **27,** 3592 (1988).
71. J. Pons, J. Casabó, F. Palacio, M.C. Morón, X. Solans and R.L. Corlin, *Inorg. Chim. Acta,* **146,** 161 (1988).
72. L.M. Flores-Vélez, J. Sosa-Rivadeneyra, M.E. Sosa-Torres, M.J. Rosales-Hoz and R.A. Toscano, *J. Chem. Soc.*, Dalton Trans., 3243 (1991).
73. W. Clegg, B.P. Straughan and A.R. Yusoff, *Acta Crystallogr.*, Sect. C, **48,** 1896 (1992).
74. P.J. Smolenaers, J.K. Beattie and N.O. Hutchinson, *Inorg. Chem.*, **20,** 2202 (1981).
75. U. Fürholz, S. Joss, H.B. Bürgë and A. Ludi, *Inorg. Chem.*, **24,** 943 (1985).
76. G. Böhm, K. Weighardt, B. Nuber and J. Weiss, *Inorg. Chem.*, **30,** 3463 (1991).
77. R. Vega, A. López-Castro and R.S Márquez, *Acta Crystallogr.*, Sect. B, **34,** 2297 (1978).
78. D. Swenson, N.C. Baenziger and D. Coucouvanis, *J. Am. Chem. Soc.*, **100,** 1932 (1978).
79. I.W. Nowell, A.G. Cox and E.S. Raper, *Acta Crystallogr.*, Sect. B, **35,** 3047 (1979).
80. R.S.Z. Kowalski, N.A. Bailey, R. Mulvaney, H. Adams, D.A. O'Cleirigh and J.A. McCleverty,

Trans. Met. Chem., **6**, 64 (1981). J.A. McCleverty, R.S.Z. Kowalski, N.A. Bailey, R. Mulvaney and D.A. O'Cleirigh, *J. Chem. Soc.*, Dalton Trans., 627 (1983).
81. J.A. McCleverty, N.J. Morrison, N. Spencer, C.C. Ashworth, N.A. Bailey, M.R. Johnson, J.W.A. Smith, B.A. Tabbiner and C.R. Taylor, *J. Chem. Soc.*, Dalton Trans., 1945 (1980).
82. H.P. Klug, *Acta Crystallogr.*, **21**, 536 (1966).
83. M. Bonamico, G. Mazzone, A. Vaciago and L. Zambonelli, *Acta Crystallogr.*, **19**, 898 (1965).
84a. Z.V. Zvonkova, A.N. Hvatkina and N.S. Ivanova, *Kristallografiya*, **12**, 1065 (1967).
84b. T. Ikeda and H. Hagihara, *Acta Crystallogr.*, **21**, 919 (1966).
85. L. Golič, N. Bulc and W. Dietzsch, *Acta Crystallogr.*, Sect. C, **42**, 811 (1986).
86. A. Müller, J. Schimanski, U. Schimanski and H. Bogge, *Z. Naturforsch.*, **40b**, 1277 (1985).
87a. M. Bonamico, G. Dessy, V. Fares and L. Scaramuzza, *J. Chem. Soc.*, Dalton Trans., 2515 (1972).
87b. S.L. Lawton and G.T. Kokotailo, *Inorg. Chem.*, **8**, 2410 (1969).
88. M. Bonamico, G. Dessy, V. Fares and L. Scaramuzza, *J. Chem. Soc.*, A, 3191 (1971).
89. R. Beckett and B.F. Hoskins, *J. Chem. Soc.*, Dalton Trans., 908 (1975).
90. J. Stach, R. Kirmse, J. Sieler, U. Abram, W. Dietzsch, R. Böttcher, L.K. Hansen, H. Vergoosen, M.C.M. Gribnau and C.P. Keijzers, *Inorg. Chem.*, **25**, 1369 (1986).
91. J.P. Fackler, Jr., J.A. Fetchin and D.C. Fries, *J. Am. Chem. Soc.*, **94**, 7323 (1972).
92. P. Trouélon, J. Lefebvre and P. Derollez, *Acta Crystallogr.*, Sect. C, **40**, 386 (1984).
93. P. Trouélon, J. Lefebvre and P. Derollez, *Acta Crystallogr.*, Sect. C, **41**, 846 (1985).
94. W. De W. Horrocks, Jr., J.N. Ishley and R.R. Whittle, *Inorg. Chem.*, **21**, 3265 (1982).
95. C. Eigenbrot, P. Osvath, A.G. Lappin, N.F. Curtis and D.C. Weatherburn, *Acta Crystallogr.*, Sect. C, **44**, 2085 (1988).
96. P.W.R. Corfield, L.M. Baltusis and S.J. Lippard, *Inorg. Chem.*, **20**, 922 (1981).
97. N. Jeyama, T. Sugawara, K. Sesaki, A. Nakamura, S. Yamashita, Y. Wakatsuki, H. Yamazaki and N. Yasuoka, *Inorg. Chem.*, **27**, 741 (1988).
98. M. Bonamico and G. Dessey, *J. Chem. Soc.*, A, 264 (1971).
99. G. Matsubayashi, K. Akiba and T. Tanaka. *J. Chem. Soc.*, Dalton Trans., 115 (1990).
100. D. Fenske, S. Magull and K. Dehnicke, *Z. Naturforsch*, **46b**, 1011 (1991).
101. K. Hasebe, T. Asahi and K. Gesi, *Acta Crystallogr.*, Sect. C, **46**, 218 (1990).
102. M.L. Werk, G. Chapus and F.J. Zúñiga, *Acta Crystallogr.*, Sect. B, **46**, 187 (1990).
103. R. Han, I.B. Gorrell, A.G. Looney and G. Parkin, *J. Chem. Soc.*, Chem. Commun., 717 (1991).
104. R. Alsfaser, S. Trofimenko, A. Looney, G. Parkin and H. Vahrenkamp, *Inorg. Chem.*, **30**, 4098 (1991).
105. W.L. Driessen, H.L. Blonk, R.A.G. de Graaff and J. Reedijk, *Acta Crystallogr.*, Sect. C, **43**, 1516 (1987).
106. K. Yoon and G. Parkin, *Inorg. Chem.*, **31**, 1656 (1992).
107. R.J. Read and M.N.G. James, *J. Am. Chem. Soc.*, **103**, 6947 (1981).
108. P.M. Schaber, J.C. Fettinger, M.R. Churchill, D. Naicwajek and K. Fries. *Inorg. Chem.*, **27**, 1641 (1988).
109. Z.G. Aliev, A.M. Karateev and L.O. Atovmjan, *Koord. Khim.*, **14**, 530 (1988).
110. K. Folting, J.C. Huffman, R.L. Bansemer, K.G. Caulton, J.L. Martin and P.D. Smith, *Inorg. Chem.*, **23**, 4589 (1984).
111. K. Folting, J.C. Huffman, R.L. Bansemer and K.G. Caulton, *Inorg. Chem.*, **23**, 3289 (1984).
112. M.R. Taylor, *Acta Crystallogr.*, Sect. B, **29**, 884 (1973).
113. L.G. Purnell and D.J. Hodgson, *J. Am. Chem. Soc.*, **99**, 3651 (1977).
114. A. Bencini and E. Borghi, *Inorg. Chim. Acta*, **135**, 85 (1987).
115. W.L. Steffen and G.J. Palenik, *Inorg. Chem.*, **17**, 1338 (1978).
116. M. Mazzanti, S. Gambarotta, C. Floriani, A. Chiesi-Villa and C. Guastini, *Inorg. Chem.*, **25**, 2308 (1986).
117. G.D. Andretti, L. Cavalca and A. Musatti, *Acta Crystallogr.*, Sect. B, **24**, 683 (1968).
118. P.G. Harrison, M.J. Begley, T. Kikabhai and F. Killer, *J. Chem. Soc.*, Dalton Trans., 929 (1986).
119. B.E. Villarreal-Salinas and E.O. Schlemper, *J. Cryst. Mol. Struct.*, **8**, 217 (1978).
120. R.E. De Simone and G.D. Stucky, *Inorg. Chem.*, **10**, 1808 (1971).
121. B.T. Killbourn and D. Felix, *J. Chem. Soc.*, A, 163 (1969).
122. W.D. Horrocks, Jr., J.N. Ishley, B. Holmquist and J.S. Thompson, *J. Inorg. Biochem.*, **12**, 131 (1980).
123. G.N. Nadzhafov, B.T. Usubaliev, I.R. Amiraslanov, Z.M. Movsumov and H.S. Mamedov, *Koord. Khim.*, **7**, 770 (1981).

124. A.F. Cameron, D.W. Taylor and R.H. Nuttall, *J. Chem. Soc.*, A, 3402 (1971).
125. A.F. Cameron, D.W. Taylor and R.H. Nuttall, *J. Chem. Soc.*, Dalton Trans., 1603 (1972).
126. C. Bolm, K. Weickhardt, M. Zehnder and D. Glasmacher, *Helv. Chim. Acta*, **74,** 717 (1991).
127. T. Sogo, J. Romero, A. Sousa, A. de Blas, M.L. Durán and F.E. Castellano, *Z. Naturforsch.*, **43b,** 611 (1988).
128. M. Dreher, H. Elias and H. Paulus, *Z. Naturforsch.*, **42b,** 707 (1987).
129. G.V. Romanenko and N.V. Podberezkaya, *Zh. Strukt. Khim.*, **33,** 103 (1992); Engl. Ed. p. 248.
130. P.R. Markles, G. Schat, O.S. Akkerman, F. Bickelhaupt, W.J.J. Smeets and A.L. Spek, *Organometallics*, **10,** 3538 (1991).
131. S.E. Denmork, J.P. Edwards and S.R. Wilson, *J. Am. Chem. Soc.*, **113,** 723 (1991).
132. F. Dejehet, R. Debuyst and J.P. Declercq, *J. Chim. Phys.*, **83,** 85 (1986).
133. H. Suzuki, N. Fukushima, S. Ishiguro, H. Masuda and H. Ohtaki, *Acta Crystallogr.*, Sect. C, **47,** 1838 (1991).
134. N.M. McConnell, R.O. Day and J.S. Wood, *Acta Crystallogr.*, Sect. C, **42,** 1094 (1986).
135. R.S. Sager and W.H. Watson, *Inorg. Chem.*, **7,** 1358 (1968).
136. Y. Yukawa, N. Yasukawa, Y. Ynomaia and T. Takfuchi, *Bull. Chem. Soc. Jpn.*, **58,** 1591 (1985).
137. X.M. Cheng and T.C.W. Mak, *Inorg. Chim. Acta*, **182,** 139 (1991).
138. J.P. Rose, R.A. Lalancette, J.A. Potenza and H.J. Schugar, *Acta Crystallogr.*, Sect. B, **36,** 2409 (1980).
139. C.A. Kosky, J.P. Gayda, J.F. Gibson, S.F. Jones and D.J. Williams, *Inorg. Chem.*, **21,** 3173 (1982).
140. M.B. Cingi, C. Guastini, A. Musatti and M. Nardelli, *Acta Crystallogr.*, Sect. B, **28,** 667 (1972).
141. M. Herceg and J. Fischer, *Acta Crystallogr.*, Sect. B, **30,** 1289 (1974).
142. M. Bonamico, G. Dessy, V. Fares and L. Scaramuzza, *J. Chem. Soc.*, Dalton Trans., 67 (1976).
143. L. Cavalca, G.F. Gasparri, G.D. Andreetti and P. Domiano, *Acta Crystallogr.*, **22,** 90 (1967).
144. I. Potočňák, M. Dunaj-Jurčo, V. Petříček and J. Černák, *Acta Crystallogr.*, in press.
145. K. Smolander, M. Ahlgrén, M. Melník, J. Skoršcpa and K. Györyová, *Acta Crystallogr.*, in press.
146. B.F. Hoskins and C.D. Pannan, *Inorg. Nucl. Chem. Lett.* **11,** 405 (1975).
147. F. Dejehet, R. Debuyst, F. Mullie, J.M. Arietta, G. Germain and M. Van Meerssche, *J. Chim. Phys.*, **80,** 355 (1983).
148. P. Bell and W.S. Sheldrick, *Z. Naturforsch.*, **39b,** 1732 (1984).
149. A. Hazell, *Acta Crystallogr.*, Sect. C, **44,** 445 (1988).
150. O.S. Roshynkina, A.V. Bulatov, Ya.H. Samovarov, Yu.L. Slovohotov and Yu.T. Struchkov, *Koord. Khim.*, **13,** 321 (1987).
151. G. Sawitzki and H.G. von Schnering, *Chem. Ber.*, **107,** 3266 (1974).
152. M. Bresciani Pahor, L. Randaccio and E. Libertini, *Inorg. Chim. Acta*, **45,** L11 (1980).
153. I.V. Isakov and E.V. Zvonkova, *Dokl. Akad. Nauk, SSSR.* **145,** 801 (1962).
154. V.K. Belsky, N.R. Streltsova, B.M. Bulychev, P.A. Storozhenko, L.V. Ivankina and A.I. Gorbunov, *Inorg. Chim. Acta*, **164,** 211(1989).
155. Yu. A. Sokolova, L.O. Amobmjan and M.A. Poraj-Koshits, *Zh. Strukt. Khim.*, **7,** 855 (1966).
156. W.L. Steffen and G.J. Palenik, *Acta Crystallogr.*, Sect. B, **32,** 298 (1976).
157. H. Lynton and M.C. Sears, *Can. J. Chem.*, **49,** 3418 (1971).
158. W.L. Steffen and G.J. Palenik, *Inorg. Chem.*, **16,** 1119 (1977).
159. A.V. Ablov and T.I. Malinovskij, *Dokl. Akad. Nauk SSSR*, **123,** 677 (1958).
160. B.K.S. Lundberg, *Acta Crystallogr.*, **21,** 901 (1966).
161. I. Sotofte and K. Nielsen, *Acta Chem. Scand.*, Ser. A, **35,** 739 (1981).
162. E. Bouwman, W.L. Driessen, R.A.G. de Graaff and J. Reedijk, *Acta Crystallogr.*, Sect. C, **40,** 1562 (1984).
163. M.A. Khan and D.G. Tuck, *Acta Crystallogr.*, Sect. C, **40,** 60 (1984).
164. H.S. Preston and C.H.L. Kennard, *J. Chem. Soc.*, A, 1956 (1969).
165. F.H. van der Steen, H. Kleijn, A.L. Spek and G. van Koten, *J. Org. Chem.*, **56,** 5868 (1991).
166. W.B. Tolman, S. Liu, J.G. Bentsen and S.J. Lippard, *J. Am. Chem. Soc.*, **113,** 152 (1991).
167. C. Bolm, K. Weickhardt, M. Zehnder and T. Ranff, *Chem. Ber.*, **124,** 1173 (1991).
168. S. Htoon and M.F.C. Ladd, *J. Cryst. Mol. Struct.*, **3,** 95 (1973).
169. P.K. Sen Gupta, L.W. Houk, D. van der Helm and M.B. Hossain, *Acta Crystallogr.*, Sect. B, **38,** 1818 (1982).

170. F. Cariati, G. Ciani, L. Menabue, G.C. Pellacani, G. Rassu and N. Sironi, *Inorg. Chem.*, **22,** 1897 (1983).
171. M.B. Hursthouse, M. Motevalli, P. O'Brien, J.R. Walsh and A.C. Jones, *Organometallics* **10,** 3196 (1991).
172. M. Kaupp, H. Stoll, H. Preuss, W. Kaim, T. Stahl, G. van Koten, E. Wissing, W.J.J. Smeets and A.L. Spek, *J. Am. Chem. Soc.*, **113,** 5606 (1991).
173. A. Monge, M. Martinéz-Ripoll and S. Garciá-Blanco, *Acta Crystallogr.*, Sect. B, **34,** 2847 (1978).
174. M.J. Henderson, R.I. Papasergio, C.L. Raston, A.L. White and M.F. Lappert, *J. Chem. Soc.*, Chem. Commun., 672 (1986).
175. V.W. Day, D.H. Campbell and C.J. Michejda, *J. Chem. Soc.*, Chem. Commun., 118 (1975).
176. J. Dekker, J. Boersma, L. Fernholt, A. Haaland and A.L. Spek, *Organometallics,* **6,** 1202 (1987).
177. F.N. Musaev, E.M. Movsumov, H.S. Mamedov, I.R. Amiraslanov and A.I. Magerramov, *Koord. Khim.*, **4,** 1420 (1978).
178. F.N. Musaev, G.A. Gusejnov, B.T. Usubaliev and H.S. Mamedov, *Koord. Khim.*, **11,** 1281 (1985).
179. D.L. Greene, B.J. McCormick and C.G. Pierpont, *Inorg. Chem.*, **12,** 2148 (1973).
180. D.T. Corwin, Jr., and S.A. Koch, *Inorg. Chem.*, **27,** 493 (1988).
181. T.L. Cremers, D.R. Bloomquist, R.D. Willett and G.A. Crosby, *Acta Crystallogr.*, Sect. B, **36,** 3097 (1980).
182. M.G.B. Drew, M. Hasan, R.J. Hobson and D.A. Rice, *J. Chem. Soc.*, Dalton Trans., 1161 (1986).
183. K.D. Onan, G. Davies, M.A. El Sayed and A. El Toukly, *Inorg. Chim. Acta,* **113,** 109 (1986).
184. F.A. Djachenko, S.M. Aldoshin and L.O. Atovmjan, *Koord. Khim.*, **3,** 1754 (1977).
185. A. Mawby and H.M.N. Irwing, *J. Inorg. Nucl. Chem.*, **34,** 109 (1972).
186. J. McB. Harrowfield, C. Pakawatchai and A.H. White, *Aust. J. Chem.*, **36,** 825 (1983).
187. K.S. Math and H. Freiser, *Talanta,* 18, 435 (1971).
188. V.V. Tkachev, E.A. Kondrashkina and L.D. Atovmjan, *Zh. Strukt. Khim.*, **18,** 1049 (1977).
189. L. Ya. Pech, O.G. Matjuchina, A.N. Sobolev, A.K. Stupis, A.P. Sturis, Yu. A. Bankovskij and Ya. K. Ozols, *Koord. Khim.*, **12,** 549 (1986).
190. T.G. Tahirov, O.A. Djacehenko, D.B. Tagiev, A.L. Nivorozhkin, L.E. Nivorozhkin and V.T. Minkin, *Koord. Khim.*, **14,** 237 (1988).
191. B. Cohen, D. Mastropaolo, J.A. Potensa and H.J. Schugar, *Acta Crystallogr.*, Sect. B, **34,** 2859 (1978).
192. R. Cini, A. Cinquantini, P. Orioli and M. Sabat, *Inorg. Chim. Acta.* **41,** 151 (1980).
193. M.J.E. Hewlins, *J. Chem. Soc.*, Dalton Trans., 429 (1975).
194. L. Fanfani, A. Nunzi and P.F. Zanazzi, *Acta Crystallogr.*, Sect. B, **28,** 323 (1972).
195. R. Faure, H. Loiseleur, R. Bartnik, S. Lesniak and A. Laurent, *Cryst. Struct. Com.*, **10,** 515 (1981).
196. P.D. Vernеij, F.J. Rietmeijer, R.A.G. De Graaff, A. Erdonmez and J. Reedijk, *Inorg. Chim. Acta,* **163,** 223 (1989).
197. R. Bartnik, S. Lesniak, A. Laurent, R. Faure and H. Loiseleur, *Acta Crystallogr.*, Sect. C., **39,** 1034 (1983).
198. R.J. Read and M.N.G. James, *Acta Crystallogr.*, Sect. B, **36,** 3100 (1980).
199. J.F. Le Querler, M.M. Borel and A. Leclaire, *Acta Crystallogr.*, Sect. B, **33,** 2299 (1977).
200. J. Pickardt and P. Droas, *Acta Crystallogr.*, Sect. C, **45,** 360 (1989).
201. S. Htoon and M.F.C. Ladd, *J. Cryst. Mol. Struct.*, **4,** 357 (1974).
202. C.M. Hughes, M.C. Favas, B.W. Skeleton and A.H. White, *Aust. J. Chem.*, **38,** 1521 (1985).
203. P. Richard, A. Boulanger, J.F. Guedon, W.J. Kasowski and C. Bordeleau, *Acta Crystallogr.*, Sect. B, **33,** 1310 (1977).
204. H. Adams, N.A. Bailey, D.E. Fenton, I.G. Ford, S.J. Kitchen, M.G. Williams, P.A. Tasker, A.J. Leong and L.F. Linday, *J. Chem. Soc.*, Dalton Trans., 1665 (1991).
205. J. Dekker, J.W. Münninghoff, J. Boersma and A.L. Spek, *Organometallics,* **6,** 1236 (1987).
206. N.R. Kunchur and M.R. Truter, *J. Chem. Soc.*, **A,** 3479 (1958).
207. M. Bonamico, G. Dessy, V. Fares and L. Scaramuzza, *J. Chem. Soc.*, **A,** 3195 (1971).
208. A.I. Prisjazhnjuk, E.V. Kolchinskij, T.V. Koksharova and V.K. Belskij, *Koord. Khim.*, **12,** 1383 (1986).
209. M. Rolies and C.J. De Ranter, *Cryst. Struct. Comm.*, **6,** 275 (1977).

210. V.K. Belskij, A.I. Prisjazhnik, E.V. Kolchinskij and T.V. Koksharova, *Zh. Strukt. Khim.*, **27**, 148–5 (1986).
211. P. Souza, L. Sanz, V. Fernández, A. Arquero, E. Gutierrez and A. Monge, *Z. Naturforsch.*, **46b**, 767 (1991).
212. A.T. Bikkulova, G.G. Aleksandrov and A.P. Kapina, *Koord. Khim.*, **14**, 340 (1988).
213 L. Antolini, A.C. Fabretti, G. Franchini, L. Menabue, G.C. Pellacani, H.O. Desseyn, R. Dommisse and H.C. Hofmans, *J. Chem. Soc.*, Dalton Trans., 1921 (1987).
214. A.T. Bikkulova, V.I. Sokol and M.A. Poraj-Koshits, *Koord. Khim.*, **13**, 1429 (1987).
215. H. Yasuda, Y. Ohnuma, A. Nakamura, Y. Kai, N. Yasuoka and N. Kasai, *Bull. Chem. Soc. Jpn.*, **53**, 1101 (1980).
216. R.G. Ball, R.S. Brown and J.L. Cocho, *Inorg. Chem.*, **23**, 2315 (1984).
217. M. Mathew and G.J. Palenik, *Inorg. Chim. Acta*, **5**, 349 (1971).
218. L. Cavalca, M. Mordelli and G. Branchi, *Acta Crystallogr.*, **13**, 688 (1960).
219. C.C. Ashworth, N.A. Bailey, M. Johnson, J.A. McCleverty, N. Morrison and B. Tabbiner, *J. Chem. Soc.*, Chem. Commun., 743 (1976).
220. M. Melnik, *Coord. Chem. Rev.*, **47**, 239 (1982); and ref's therein.
221. R.L. Belford, N.D. Chasteen, M.A. Hitchman, P.K. Hon, C.E. Pfluger and I.C. Paul, *Inorg. Chem.*, **8**, 1312 (1969).
222. D.L. Cullen and E.F. Meyer, Jr., *Acta Crystallogr.*, Sect. B, **32**, 2259 (1976).
223. K.M. Borkigia, J. Fajer, L.D. Spaulding and G.J.B. Williams. *J. Am. Chem. Soc.*, **103**, 176 (1981).
224. L.D. Spaulding, L.C. Andrews and G.J.B. Williams, *J. Am. Chem. Soc.*, **99**, 6918 (1977).
225. D.M. Collins and J.L. Hoard, *J. Am. Chem. Soc.*, **92**, 3761 (1970).
226. K. Hatano, K. Kawasaki, S. Munakata and Y. Iitaka, *Bull. Chem. Soc. Jpn.*, **60**, 1985 (1987).
227. M.A. Bobrik and F.A. Walter, *Inorg. Chem.*, **19**, 3383 (1980).
228. K.M. Barkigia, M. Miura, M.A. Thompson and J. Fajer, *Inorg. Chem.*, **30**, 2233 (1991).
229. T. Kobayashi, T. Ashida, N. Uyeda, E. Suito and M. Kakudo, *Bull. Chem. Soc. Jpn.*, **44**, 2095 (1971).
230. L.D. Spaulding, P.G. Eller, J.A. Bertrand and R.H. Felton, *J. Am. Chem. Soc.*, **96**, 982 (1974).
231. S.M. Peng, Y. Wang, C.K. Chen, J.Y. Lee and D.S. Liaw, *J. Chim. Chem. Soc.* (Taijei), **33**, 23 (1986).
232. R.J. Cheng, Y.R. Chen, S.L. Wang and C.Y. Cheng, *Polyhedron*, **12**, 1353 (1993).
233. J.H. Fuhrhop, P. Krüger and W.S. Shedrick, *Liebigs Ann. Chem.*, 339 (1977).
234. N.W. Alcock, N. Herron and P. Moore, *J. Chem. Soc.*, Dalton Trans., 1282 (1978).
235. C.K. Schauer, O.P. Anderson, D.K. Lavalee, J.P. Battioni and D. Mansuy, *J. Am. Chem. Soc.*, **109**, 3922 (1987).
236. M. Mossoyan-Deneux, D. Benlian, M. Pierrot, A. Fournell and J.P. Sorbier, *Inorg. Chem.*, **24**, 1878 (1985).
237. D.K. Lavalee, A.B. Kopelove and O.P. Anderson, *J. Am. Chem. Soc.*, **100**, 3025 (1978).
238. D. Kuila, D.K. Lavalee, C.K. Schauer and O.P. Anderson, *J. Am. Chem. Soc.*, **106** 448 (1984).
239. C.W.G. Ansell, K.P. Dancey, M. McPartlin, P.A. Tasker and L.F. Linday, *J. Chem. Soc.*, Dalton Trans., 1789 (1983).
240. G. Marongiu, M. Cannas and G. Carta, *J. Coord. Chem.*, **2**, 167 (1973).
241. Yu. A. Simonov, N.V. Gerbeleu, M.D. Revenko, S.G. Shova, V.E. Zavodnik and V.G. Rusu, *Kristallografiya*, **30**, 1090 (1985).
242. M.G.B. Drew and S. Hollis, *J. Chem. Soc.*, Dalton Trans., 511 (1978).
243. H. Grewe, M.R. Udupa and B. Krebs, *Inorg. Chim. Acta*, **63**, 119 (1982).
244. E.L. Lippert and M.R. Truter, *J. Chem. Soc.*, **A**, 4997 (1960).
245. G.D. Andretti, P.C. Jain and E.C. Linfafelter, *J. Chem. Soc.*, **91**, 4112 (1969).
246. K. Takahashi, Y. Nishida and S. Kida, *Bull. Chem. Soc. Jpn.*, **57**, 2628 (1984).
247. N. Ray and B. Hathaway, *J. Chem. Soc.*, Dalton Trans., 1105 (1980).
248. N.W. Alcock, P. Moore, H.A.A. Omar and C.J. Reader, *J. Chem. Soc.*, Dalton Trans., 2643 (1987).
249. N.W. Alcock, K.P. Balakrishnan, A. Berry, P. Moore and C.J. Reader, *J. Chem. Soc.*, Dalton Trans., 1089 (1988).
250. M. Ahlgrén, U. Turpeinen and R. Hämäläinen, *Acta Chem. Scand.*, Ser. A, **36**, 841 (1982).
251. I. Mutikainen, *Inorg. Chim. Acta*, **136**, 155 (1987).
252a. S.C. Rawle, A.J. Clarke, P. Moore and N.W. Alcock, *J. Chem. Soc.*, Dalton Trans., 2755 (1992).
252b. M. Kato and T. Ito, *Inorg. Chem.*, **24**, 509 (1985).

252c. Ch. Kirchner and B. Krebs, *Inorg. Chem.*, **26,** 3569 (1987).
253. R.J. Sime, R.P. Dodge, A. Zalkin and D.H. Templeton, *Inorg. Chem.*, **10,** 537 (1971).
254. M. Di Vaira and P.L. Orioli, *Acta Crystallogr.*, Sect. B, **24,** 1269 (1968).
255. K.A. Fraser and M.M. Harding, *Acta Crystallogr.*, **22,** 75 (1967).
256. C.L. Raston, A.H. White and G. Winter, *Aust. J. Chem.*, **29,** 731 (1976).
257. J. Bertels and R. Mattes, *Z. Naturforsch.*, **40b,** 1068 (1985).
258. B. Kratochvíl, J. Ondráček, J. Novotný and V. Haber, *Acta Crystallogr.*, Sect. C, **47,** 2207 (1991).
259. E. Kimura, T. Koike and K. Toriumi, *Inorg. Chem.*, **27,** 3687 (1988).
260. J. A. Castro, J. Romero, J.A. Garciá-Vázquez, A. Macias, A. Sousa and U. Englert, *Polyhedron*, **12,** 1391 (1993).
261. D.P. Freyberg, G.M. Mockler and E. Sinn, *J. Chem. Soc.*, Dalton Trans., 447 (1976).
262. D.A. Edwards, M.F. Mahon, W.R. Martin, K.C. Molloy, P.E. Fanwick and R.A. Walton, *J. Chem. Soc.*, Dalton Trans., 3161 (1990).
263. F.W.B. Einstein and B.R. Penfold, *Acta Crystallogr.*, **20,** 924 (1966); D.E.C. Corbridge and E.G. Cox, *J. Chem. Soc.*, 594 (1956).
264. M. Vlasse, T. Rojo and D. Beltron-Porter, *Acta Crystallogr.*, Sect. C, **39,** 560 (1983).
265. G. A. Nicholson, J.I. Petersen and B.J. McCormick, *Inorg. Chem.*, **21,** 3274 (1982).
266. V.L. Goedken and G.G. Christoph, *Inorg. Chem.*, **12,** 2316 (1973).
267. G. Zakrzewski and E.C. Lingafelter, *Inorg. Chim. Acta*, **4,** 251 (1970).
268. H. Follner, *Acta Crystallogr.*, Sect. B, **28,** 157 (1972).
269. E. Labisbal, J.A. Garciá-Vázquez, C. Gómez, A. Macias, J. Romero, A. Sousa, U. Englett, and D.E. Fenton, *Inorg. Chim. Acta.*, **203,** 67 (1993).
270. D.C. Liles, M. McPartlin and P.A. Tasker, *J. Am. Chem. Soc.*, **99,** 7704 (1977).
271. C.E. Kyriatidis, P.C. Christidis, P.J. Rentzeperis and I.A. Tossidis, *Z. Kristallogr.*, **193,** 261 (1990).
272. M.A. Romero, M.P. Sánchez, M. Quirós, F. Sánchez, J.M. Salas, M.N. Moreno and R. Faure, *Can. J. Chem.*, **71,** 29 (1993).
273. F. Teixidor, L. Escrische, J. Casabó, E. Molins and C. Miravitlles, *Inorg. Chem.*, **25,** 4060 (1986).
274. H. Montgomery and E.C. Lingafelter, *Acta Crystallogr.*, **16,** 748 (1963).
275. J.D. Korp, I. Bernal, C.L. Merrill and L.J. Wilson, *J. Chem. Soc.*, Dalton Trans., 1951 (1981).
276. L. Casella, M.E. Silver and J.A. Ibers, *Inorg. Chem.*, **23,** 1409 (1984).
277. H.W. Smith, *Acta Crystallogr.*, Sect. B, **31,** 2701 (1975).
278. P.E. Bourne and M.R. Taylor, *Acta Crystallogr.*, Sect. B, **36,** 2143 (1980).
279. M.P. Gupta and J.L. Agrawal, *Cryst. Struct. Comm.*, **6,** 103 (1977).
280. J.M. Broomhead and A.D.I. Nicol, *Acta Crystallogr.*, **1,** 88 (1948).
281. A. Hargreaves, *Acta Crystallogr.*, 10, 191 (1957).
282. T.C.W. Mak and S.H. Huang, *Polyhedron*, **6,** 1111 (1987).
283. I. Persson, *Acta Chem. Scand.*, Ser. A, **36,** 7 (1982).
284. C.J. O'Connor, E. Sinn and R.L. Carlin, *Inorg. Chem.*, **16,** 3314 (1977).
285. J.S. Wood, R.O. Day, C.P. Keijzers, E. de Boer, A.E. Yildirim and A.A. Klaassen, *Inorg. Chem.*, **20,** 1982 (1981).
286. H.W. Roesky, M. Thomas, M. Noltemeyer and G.M. Sheldrick, *Angew. Chem.*, **94,** 861 (1982).
287. E.J. O'Reilly, G. Smith, C.H.L. Kennard and T.C.W. Mak, *Aust. J. Chem.*, **40,** 1147 (1987).
288. J.P. Battaglia, A.B. Corradi, L. Menabue, M. Saladini, M. Sola and G.B. Garioti, *Inorg. Chim. Acta*, **107,** 73 (1985).
289. A.S. Ancyshkima, L.M. Dikareva, M.A. Poraj-Koshits, L.E. Fykin, V. Ya. Dudarev and I.G. Gusejnov, *Koord. Khim.*, **8,** 1256 (1982).
290. F. Dejchet, R. Debuyst, B. Ledieu, J.P. Declercq, G. Germain and M. Van Meerssche, *Inorg. Chim. Acta*, **30,** 197 (1978).
291. C.H.L. Kennard, E.J. O'Reilly, G. Smith and T.C.W. Mak, *Aust. J. Chem.*, **38,** 1381 (1985).
292. C.H.L. Kennard, E.J. O'Reilly, S. Schiller, G. Smith and A.H. White, *Aust. J. Chem.*, **39,** 1823 (1986).
293. M.P. Gupta, R.D. Sahu and P.R. Maulik, *Z. Kristallogr.*, **163,** 151 (1983).
294. K. Rissanen, J. Valkonen, P. Kokkonen and M. Leskelä, *Acta Chem. Scand.*, Ser. A, **41,** 299 (1987).
295. G. Smith, D.E. Lynch, T.C.W. Mak, W.H. Yip and C.H.L. Kennard, *Polyhedron*, **12,** 203 (1993).

296. W.H. Chan, T.C.W. Mak, W.H. Vip, G. Smith, E.J. O'Reilly and C.H.L. Kennnard, *Polyhedron,* **6,** 881 (1987).
297. A. Braibanti, M.A. Pellinghelli, A. Tiripicchio and M. Tiripicchio Camellini, *Acta Crystallogr.,* Sect. B, **27,** 1240 (1971).
298. G. Smith, E.J. O'Reilly, C.H.L. Kennard, K. Stadnicka and B. Oleksyn, *Inorg. Chim., Acta,* **47,** 111 (1981).
299. J.N. van Niekerk, F.R.L. Schoening and J.H. Talbot, *Acta Crystallogr.,* **6,** 720 (1953).
300. G.A. Gusejnov, F.N. Musaev, I.R. Amiraslanov, B.T. Usubaliev and H.S. Mamedov, *Koord. Khim.,* **9,** 1687 (1983).
301. K.D. Singh, S.C. Jain, T.D. Sakore and A.B. Biswas, *Acta Crystallogr.,* Sect. B, **31,** 990 (1975).
302. X. Solans, M. Font-Altaba, J.L. Briansó, A. Llobet, F. Teixidor and J. Casabó, *Acta Crystallogr.,* Sect. C, **39,** 1512 (1983).
303. J.A. Pretorius and J.C.A. Boeyens, *J. Inorg. Nucl. Chem.,* **40,** 1519 (1978).
304. B.M. Antti, *Acta Chem. Scand.,* Ser. A, **30,** 103 (1976).
305a. C. Brassy, M.Ch. Michaud, J. Delettré and J.P. Mornon, *Acta Crystallogr.,* Sect. B, **30,** 2848 (1974).
305b. V.P. Nikolaev, T.S. Hodashova, M.A. Poraj-Koshits, L.A. Butman and G.V. Cincandze, *Koord. Khim.,* **11,** 1386 (1985).
306a. A. Caneschi, D. Gabteschi, R. Sessoli, C.I. Cabello, P. Rey, A.L. Barra and L.C. Brunel, *Inorg. Chem.,* **30,** 1882 (1991).
306b. H.W. Roesky, H. Djarrah, M. Thomas, B. Krebs and G. Henkel, *Z. Naturforsch.,* **38b,** 168 (1983).
307. C. Sandmark and C.I. Brändén, *Acta Chem. Scand.,* **21,** 993 (1967).
308. T.P.J. Garrett, J.M. Guss and H.C. Freeman, *Acta Crystallogr.,* Sect. C, **39,** 1027 (1983).
309. G.V. Cincandze, Z.V. Mikelashvili, T.T. Civcivadze and V.C. Sergienko, *Soobch. Akad. Nauk Gruzh.* SSR, **96,** 85 (1979).
310. M. Mikami-Kido and Y. Saito, *Acta Crystallogr.,* Sect. B, **38,** 452 (1982).
311. V.H. Sabizov, A.S. Bacanov, Yu. T. Struchkov, G.G. Aleksandrov, M.A. Azizov and A.A. Shabilalov, *Koord. Khim.,* **8,** 384 (1982).
312. J. Glerup, P.A. Goodson, D.J. Hodgson, K. Michelsen, K.M. Nielsen and H. Weihe, *Inorg. Chem.,* **31,** 4611 (1992).
313. C. Chandburi, C. Stockheim, K. Wieghardt, W. Deck, R. Gregorzik, H. Vahrenkamp, B. Nuber and J. Weiss, *Inorg. Chem.,* **31,** 1451 (1992).
314. T. Astley, A.J. Carty, A.A. Hitchman, G.L. Rowbottom, B.W. Skelton and A.H. White, *J. Chem. Soc.,* Dalton Trans., 1981 (1991).
315. P.G. Hodgson and B.R. Penfold, *J. Chem. Soc.,* Dalton Trans., 1870 (1974).
316. T. Ito, M. Kato and H. Ito, *Bull. Chem. Soc. Jpn.,* **57,** 2634 (1984).
317. R.A.D. Wentworth, P.S. Dahl, C.J. Huffman, W.O. Gillum, W.E. Streir and J.C. Huffman, *Inorg. Chem.,* **21,** 3060 (1982).
318. P.V. Bernhardt, G.A. Lawrence, M. Maeder, M. Rossignoli and T.W. Hambley, *J. Chem. Soc.,* Dalton Trans., 1167 (1991).
319. M.R. Churchill and A.H. Reis, Jr., *Inorg. Chem.,* **12,** 2280 (1973).
320. J.D. Oliver and L.C. Strickland, *Acta Crystallogr.,* Sect. C, **42,** 952 (1986).
321. M.G.B. Drew, D.A. Rice and Ch.W. Timewell, *J. Chem. Soc.,* Dalton Trans., 144 (1975).
322. P. Lumme, G. Lundgren and W. Mark, *Acta Chem.* Scand., **23,** 3011 (1969).
323. W.E. Broderick, M.R. Pressprich, U. Geiser, R.D. Willett and J.I. Legg, *Inorg. Chem.,* **25,** 3372 (1986).
324. V.H. Sabirov, A.S. Bacanov, Yu. T. Struchkov and G.G. Aleksandrov, *Koord. Khim.,* **10,** 1113 (1984).
325. B. Walsh and B.J. Hathaway, *J. Chem. Soc.,* Dalton Trans., 681 (1980).
326. F.A. Cotton, G.E. Lewis, C.A. Murillo, V. Schwotzer and G. Valle, *Inorg. Chem.,* **23,** 4038 (1984).
327. S.Z. Haider, K.M.A. Malik, S. Das and M.B. Hursthouse, *Acta Crystallogr.,* Sect. C, **40,** 1147 (1984).
328. M. Quirós, J.M. Salas, M.P. Sánchez, J.R. Alabart and R. Faure, *Inorg. Chem.,* **30,** 2916 (1991).
329. W.S. Sheldrick and P. Bell, *Z. Naturforsch.,* **41b,** 1117 (1986).
330a. M.A. Hitchman, R. Thomas, B.W. Shelton and A.H. White, *J. Chem. Soc.,* Dalton Trans., 2273 (1983).

330b. A.J. Finney, M.A. Hitchman, C.L. Raston, G.L. Rowbottom and A.H. White, *Aust. J. Chem.*, **34,** 2159 (1981).
331. J. Pradilla-Sorzano and J.P. Fackler, Jr., *Inorg. Chem.*, **12,** 1174 (1973).
332. J.A. Pretorius and J.C.A. Boeyens, *J. Inorg. Nucl. Chem.*, **40,** 1745 (1978).
333. J.A. Pretorius and J.C.A. Boeyens, *J. Inorg. Nucl. Chem.*, **40,** 407 (1978).
334. A. Laidoudi, N. Kheddar and M.C. Brianso, *Acta Crystallogr.*, Sect. B, **34,** 782 (1978).
335. D.M. Thompson, W. Balenovich, L.H.M. Hornich and M.F. Richardson, *Inorg. Chim. Acta,* **46,** 199 (1980).
336. S.B. Teo, S.G. Teoh, J.R. Rogers and M.R. Snow, *J. Chem. Soc., Chem. Commun.*, 141 (1982).
337. R. Faure and H. Loiseleur, *Acta Crystallogr.*, Sect. B, **28,** 811 (1972).
338. G.P. Palenik, *Acta Crystallogr.*, **17,** 696 (1964).
339. L.L. Merritt, R.T. Cady and B.W. Mundy, *Acta Crystallogr.*, **7,** 473 (1954).
340. M.N. Moreno, J.M. Salas, E. Colacio, M.P. Sanchez and F. Nieto, *Acta Crystallogr.*, Sect. C, **42,** 407 (1986).
341. H. Saarinen, J. Korvenranta and E. Näsäkkälä, *Finn. Chem. Lett,* 155 (1977).
342. R. Hämäsläinen, *Finn. Chem. Lett.*, 113 (1977).
343. A. Takenata, H. Utsumi, N. Ishihara, A. Furusaki and I. Nitta, *J. Chem. Soc. Jpn.*, Pure Chem., **91,** 921 (1970).
344. N.V. Kozhemjak, N.V. Podberezskaja and V.V. Bakakin, *Zh. Strukt. Khim.*, **21,** 124 (1980).
345. L.M. Sholniková, A.E. Obobovskaja and E.A. Shugam, *Zh. Strukt. Khim.*, **11,** 54 (1970).
346. M. Nardelli, G. Fava and G. Giraldi, *Acta Crystallogr.*, **16,** 343 (1963).
347. F. Bigoli, A. Braibanti, M.A. Pellinghelli and A. Tiripicchio, *Acta Crystallogr.*, Sect. B, **29,** 2344 (1973).
348. N.H. Hu and Y.S. Liu, *Acta Crystallogr.*, Sect. C, **47,** 2324 (1991).
349. H. Sakaguchi, H. Anzai, K. Furuhata, H. Ogura and Y. Iitaka, *Chem. Pharm. Bull.*, **25,** 2267 (1977).
350. A.J. Finney, M.A. Hitchman, C.L. Ratton, G.L. Rowbottom and A.H. White, *Aust. J. Chem.*, **34,** 2061 (1981).
351. A. Walsh, B. Walsh, B. Murphy and B.J. Hathaway, *Acta Crystallogr.*, Sect. B, **37,** 1512 (1981).
352. H.E. Mabrouk, D.G. Tuck and M.A. Khan, *Inorg. Chim. Acta,* **129,** 75 (1987).
353. A. Braibanti, G. Bigliardi, A.M. Manotti Lanfredi and A. Tiripicchio, *Nature,* **211,** 1174 (1966); A. Ferrari, A. Braibanti, G. Bigliardi and A.M. Lanfredi, *Z. Kristallogr.*, **122,** 259 (1965).
354. W. Fitzgerald, B. Hathaway and C.J. Simmons, *J. Chem. Soc.*, Dalton Trans., 141 (1985).
355. P.N.W. Baxter, J.A. Connor, W.B. Schweizer and J.D. Wallis, *J. Chem. Soc.*, Dalton Trans., 3015 (1992).
356. C.A. Schauer, O.P. Anderson, S.S. Eaton and G.R. Eaton, *Inorg. Chem.*, **24,** 4082 (1985).
357. M.L. Duran, J. Romero, J.A. Garcia-Vazquez, R. Castro, A. Castiñeiras and A. Sousa, *Polyhedron,* **10,** 197 (1991).
358. N.A. Bell, E. Johnson, L.A. March, S.D. Marsden, I.W. Nowell and Y. Walter, *Inorg. Chim. Acta,* **156,** 205 (1989).
359. K.R. Adam, K.P. Dancey, A.J. Leong, L.F. Linday, B.J. McCool, M. McPartlin and P.A. Tasker, *J. Am. Chem. Soc.*, **110,** 8471 (1988); K.R. Adam, K.P. Dancey, B.A. Harrison, A.J. Leong, L.F. Linday, M. McPartlin and P.A. Tasker, *J. Chem. Soc.*, Chem. Commun., 1351 (1983).
360. I.A. Krol, V.M. Agre, M.S. Kvernadze, N.I. Pirchalova and A.G. Njudochkin, *Koord. Khim.*, **7,** 800 (1981).
361. M. Nardelli, G. Fava Gasparri, P. Boldrini and G. Giraldi Battistini, *Acta Crystallogr.*, **19,** 491 (1965).
362. F. Dejehet, R. Debuyst, Y.Y. Wei, J.P. Declerq and B. Tinant, *J. Chim. Phys.*, **84,** 107 (1987).
363. G. Smith, E.J. O'Reilly and C.H.L. Kennard, *Polyhedron,* **6,** 871 (1987).
364. J.H. Burns and G.J. Lumetta, *Acta Crystallogr.*, Sect. C, **47,** 2069 (1991).
365. M.G.B. Drew and S.M. Nelson, *Acta Crystallogr.*, Sect. A, **31,** 5140 (1975).
366. A.H. White, and A.C. Willis, *J. Chem. Soc.*, Dalton Trans., 1377 (1977).
367. Z.P. Haque, D.C. Liles, M. McPartlin and P.A. Tasker, *Inorg. Chim. Acta,* **23,** L21 (1977).
368. D. Wester and G.J. Palenik, *Inorg. Chem.*, **15,** 755 (1976).
369. S. Ianelli, G. Minardi, C. Pelizzi, G. Pelizzi, L. Reverberi, C. Solinas and P. Tarasconi, *J. Chem. Soc.*, Dalton Trans., 2113 (1991).
370. G.J. Palenik and D.W. Wester, *Inorg. Chem.*, **17,** 864 (1978).
371. D.C. Liles, M. McPartlin and P.A. Tasker, *J. Chem. Soc.*, Dalton Trans., 1631 (1987).

372. C. Bellitto, L. Gastaldi and A.A.G. Tomlinson, *J. Chem. Soc.*, Dalton Trans., 989 (1976).
373. N.N. Greenwood, J.A. McGinnetty and J.D. Owen, *J. Chem. Soc.*, A, 809 (1971).
374. M.G.B. Drew, *Progr. Inorg. Chem.*, **23,** 67 (1977).
375. D.L. Kepert, *Progr. Inorg. Chem.*, **25,** 41 (1979).
376. S.S. Al-Juaid, N.H. Buttrus, C. Eaborn, P.B. Hitchcock, A.T.L. Roberts, J.D. Smith and A.C. Sullivan, *J. Chem. Soc.*, Chem. Commun., 908 (1986).
377. D. Coucovanis, K. Greiwe, A. Sallfoglou, P. Challen, A. Simopoulus and A. Koslikas, *Inorg. Chem.*, **27,** 593 (1988).
378. M.R.P. van Vliet, G. van Koten, P. Buysingh, J.T.B.H. Jastrzebski and A.L. Spek, *Organometallics*, **6,** 537 (1987).
379. P.L. Orioli, M. Di Vaira and L. Sacconi, *Inorg. Chem.*, **5,** 400 (1966).
380. Ch.T. Chen, W.K. Chang, S.Ch. Shen, G.H. Lee, T.I. Ho, Y.Ch. Lin and Y. Wang, *J. Chem. Soc.*, Dalton Trans., 1569 (1991).
381. A.I. Gusev, E.B. Chuklanova, B. Murzubraimov and A. Toktomamatov, *Koord. Khim.*, **11,** 1154 (1985); E.B. Chuklanova, A. Toktomamatov, B. Murzubraimov and A.I. Gusev, *ibid*, **14,** 519 (1988).
382. B.L. Barnett, H.C. Kretschmar and F.A. Hartman, *Inorg. Chem.*, **16,** 1834 (1977).
383. M.M. Olmstead, P.P. Power and S.C. Shoner, *J. Am. Chem. Soc.*, **113,** 3379 (1991).
384. R.M. Fabicon, M. Parvez and H.G. Richey, Jr., *J. Am. Chem. Soc.*, **113,** 1412 (1991).
385. S.C. Goel, M.Y. Chiang and W.E. Buhro, *J. Am. Chem. Soc.*, **113,** 7069 (1991).
386. N.A. Bell, P.T. Moseley, H.M.M. Shearer and C.B. Spencer, *Acta Crystallogr.*, Sect. B, **36,** 2950 (1980).
387. C. Lorenzini, C. Pelizzi, G. Pelizzi and G. Predieri, *J. Chem. Soc.*, Dalton Trans., 2155 (1983).
388. N.A. Bell, H.M.M. Shearer and C.B. Spencer, *Acta Crystallogr.*, Sect. C, **39,** 1182 (1983).
389. A.L. Spek, J.T.B.H. Jastrzerski and G. van Koten, *Acta Crystallogr.*, Sect. C, **43,** 2006 (1987).
390. J.H. Wilhelm and U. Müller, *Z. Naturforsch.*, **44b,** 1037 (1989).
391. S.P. Kolesnikov, I.V. Ljubkovskaja, M.Yu. Anmipin, Yu.T. Struchkov and O.M. Nefjedov, *Izv. Akad. Nauk SSSR*, Ser. Khim., 79 (1985).
392. F.A. Cotton, S.A. Duraj, M.W. Extine, G.E. Lewis, W.J. Roth, C.D. Schmulbach and W. Schwotzer, *J. Chem. Soc.*, Chem. Commun., 1377 (1983); F.A. Cotton, S.A. Duraj and W.J. Roth, *Inorg. Chem.*, **24,** 913 (1985).
393. R.J. Bouma, J.H. Teuben, W.R. Beukema, R.L. Bansemer, J.C. Huffman and K.G. Caulton, *Inorg. Chem.*, **23,** 2715 (1984).
394. D.B. Sekutowski and G.D. Stucky, *Inorg. Chem.*, **14,** 2192 (1975).
395. A.D. Watson, Ch.P. Rao, J.R. Dorfman and R.H. Holm, *Inorg. Chem.*, **24,** 2820 (1985).
396. W.P. Chung, J.C. Dewan and A.A. Walters, *Inorg. Chem.*, **30,** 4280 (1991).
397. I.L. Abrahams, C.D. Garner and W. Clegg, *J. Chem. Soc.*, Dalton Trans., 1577 (1987).
398. M. Bochmann, G. Bwembya, R. Grinter, J. Lu, K.J. Webb, D.J. Williamson, M.B. Hursthouse and M. Mazid, *Inorg. Chem.*, **32,** 532 (1993).
399. H. Miyamae, M. Ito and H. Iwasaki, *Acta Crystallogr.*, Sect. B, **35,** 1480 (1979).
400. M. Bonamico, G. Mazzone, A.Vaciago and L. Zambonelli, *Acta Crystallogr.*, **19,** 898 (1965).
401. M.B. Hursthouse, M.A. Malik, M. Motevalli and P. O'Brien, *Organometallics*, **10,** 730 (1991).
402. B. Kaptein, L. Wang-Griffin, G. Barf and R.M. Kellogg, *J. Chem. Soc.*, Chem. Commun., 1457 (1987).
403. J. Skoršepa, K. Györyová, M. Melník, K. Smolander and M. Ahlgrén, manuscript in preparation.
404. J. Dekker, J. Boersma and G.J.M. van der Kerk, *J. Chem. Soc.*, Chem. Commun., 553 (1983).
405. E. Kellö, V. Vrábel, V. Kettmann and J. Garaj, *Coll. Czechosl. Chem. Commun.*, **48,** 1272 (1983).
406. V.M. Agre and E.A. Shugam, *Zh. Strukt. Khim.*, **13,** 660 (1972).
407. H. Wunderlich, *Acta Crystallogr.*, Sect. B, **38,** 614 (1982).
408. M. Calligaris, G. Nardin and A. Ripamonti, *J. Chem. Soc.*, A, 714 (1971).
409. W.S. Sheldrick and J. Engel, *J. Chem. Soc.*, Chem. Commun., 5 (1980); *Acta Crystallogr.*, Sect. B, **37,** 250 (1981).
410. A. Osuka, S. Nakajima, T. Nagata, K. Maruyama and K. Toriumi, Angew. Chem. Int. Ed. Engl., **30,** 582 (1991).
411. G.D. Andreetti, L. Cavalca, P. Domiano and A. Musatti, *Sc. Chim.*, 1100 (1968).
412. F. Bigoli, A. Braibanti, M.A. Pellinghelli and A. Tiripicchio, *Acta Crystallogr.*, Sect. B, **29,** 2708 (1973).

413. J.C. Cuevas, J. de Mendoza, P. Prados, F. Hernández-Cano and C. Foces-Foces, *J. Chem. Soc.*, Chem. Commun., 1641 (1986).
414. W. Clegg, I.R. Little and B.P. Straughan, *J. Chem. Soc.*, Dalton Trans., 1283 (1986).
415. A. Bencini, A. Bianchi, E. Garcia-España, S. Mangani, M. Micheloni, P. Orioli and P. Paoletti, *Inorg. Chem.*, **27,** 1104 (1988).
416. A. Bencini, A. Bianchi, P. Dapporto, E. Garcia-España, M. Micheloni and P. Paoletti, *Inorg. Chem.*, **28,** 1188 (1989).
417. J.A. McCleverty, N. Spencer, N.A. Bailey, *J. Chem. Soc.*, Dalton Trans., 1939 (1980).
418. N.F. Curtis, I. Ross, N. McCormick and T.N. Waters, *J. Chem. Soc.*, Dalton Trans., 1537 (1973).
419. Y.Nakacho, T. Misawa, T. Fujiwara, A. Wekahara and K. Tomita, *Bull. Chem. Soc. Jpn.*, **49,** 595 (1976).
420. C. Flassbeck, K. Wieghardt, E. Bill, Ch. Butzlaff, A.X. Trautwein, B. Nuber and J. Weiss, *Inorg. Chem.*, **31,** 21 (1992).
421. P. Orioli, R. Cini, D. Donati and S. Mangani, *J. Am. Chem. Soc.*, **103,** 4446 (1981).
422. P.J.M.W.L. Birker, A.J. Schierbeek, G.C. Verschoor and J. Reedijk, *J. Chem. Soc.*, Chem. Comm., 1124 (1981).
423. M.J. Bennett, F.A. Cotton and R. Eiss, *Acta Crystallogr.*, Sect. B, **24,** 904 (1968).
424. W. Clegg, I.R. Little and B.P. Straughar, *Inorg. Chem.*, **27,** 1916 (1988).
425. A.L. Spek and G. Vos, *Acta Crystallogr.*, Sect. C, **39,** 990 (1983).
426. T. Aoyagi, H.M.M. Shearer, K. Wade and G. Whitehead, *J. Organometal. Chem.*, **14,** C29 (1978); H. Koyama and Y. Saito, *Bull. Chem. Soc. Jpn.*, **27,** 112 (1954).
427. L. Hiltunen, M. Leskelä, M. Mákelá and L. Niinisto, *Acta Chem. Scand.*, Ser. A, **41,** 548 (1987).
428. M. Corbett and B.F. Hoskins, *Inorg. Nucl. Chem. Lett.* **6,** 261 (1970).
429. P.G. Harrison, M.J. Begley, T. Kikabhai and F. Killer, *J. Chem. Soc.*, Dalton Trans., 925 (1986).
430. D. Johnstone, J.E. Ferguson and W.T. Robinson, *Bull. Chem. Soc. Jpn.*, **45,** 3721 (1972).
431a. M.B. Hursthouse, M.A. Malik, M. Motevalli and P. O'Brien, *J. Chem. Soc.*, Chem. Commun., 1690 (1991).
231b. G. Struchmeier, U. Thewalt and J.H. Fuhrhop, J. Am. Chem. Soc., **98,** 278 (1976).
432. H.M.M. Shearer and C.B. Spencer, *Acta Crystallogr.*, Sect. B, **36,** 2046 (1980).
433. T. Akimoto, M. Maeda, A. Tsuji and Y. Iitaka, *Chem. Pharm. Bull.*, **27,** 424 (1979).
434. W. Haase, R. Mergehenn and R. Allmann, *Acta Crystallogr.*, Sect. B, **31,** 1184 (1975).
435. F.H. van der Steen, J. Boersma, A.L. Spek and G. van Koten, *Organometallics*, **10,** 2467 (1991).
436. T. Ito, *Acta Crystallogr.*, Sect. B, **28,** 1697 (1972).
437. J. Boersma, A.L. Spek and J.G. Noltes, *J. Organomet. Chem.*, **81,** 7 (1974).
438. Y. Kai, M. Morita, N. Yasuoka and N. Kasai, *Bull. Chem. Soc. Jpn.*, **58,** 1631 (1985).
439. A.M. Arif, A.H. Cowley, R.A. Jones and S.D. Koschmieder, *J. Chem. Soc.*, Chem. Commun., 1319 (1987).
440. I.G. Dance, *Inorg. Chem.*, **20,** 2155 (1981).
441. G.W. Adamson, N.A. Bell and H.M.M. Shearer, *Acta Crystallogr.*, Sect. B, **38,** 462 (1982).
442. M.L. Ziegler and J. Weiss, *Angew. Chem.*, **82,** 931 (1970).
443. M. Ishimori, T. Hagiwara, T. Tsuruta, Y. Kai, N. Yasuoka and N. Kasai, *Bull. Chem. Soc. Jpn.*, **49,** 1165 (1976).
444. D. Attanasio, G. Dessy and V. Fares, *J. Chem. Soc.*, Dalton Trans., 28 (1979).
445. I.G. Dance, *J. Chem. Soc.*, Chem. Commun., 818 (1980); *Aust. J. Chem.*, **38,** 1391 (1985).
446. I. Casals, W. Clegg and P. González-Duarte, *J. Chem. Soc.*, Chem. Commun., 655 (1991).
447. I.G. Dance, A. Choy and M.I. Scudder, *J. Am. Chem. Soc.*, **106,** 6285 (1984).
448. A.V. Capilla and R.A. Aranda, *Cryst. Strukt. Commun.*, **8,** 795 (1979).
449. W. Clegg, I.R. Little and B.P. Straughan, *Acta Crystallogr.*, Sect. C, **42,** 1701 (1986).
450. W. Clegg, I.R. Little and B.P. Straughan, *Acta Crystallogr.*, Sect. C, **43,** 456 (1987).
451. E. Goldschmied, A.D. Rae and N.C. Stephenson, *Acta Crystallogr.*, Sect. B, **33,** 2117 (1977).
452. G.A. Gusejnov, F.N. Musaev, B.T. Usubaliev, I.R. Amiraslanov and H.S. Mamedov, *Koord. Khim.*, **10,** 117 (1984).
453. Y. Nakacho, T. Misawa, T. Fujiwara, A. Wakahara and K. Tomita, *Bull. Chem. Soc. Jpn.*, **49,** 58 (1976).
454. S. Natarajan, D.S. Sake Gowda and L. Cartz, *Acta Crystallogr.*, Sect. B, **30,** 401 (1974).

455. W.H. Chan, T.C.W. Mak, W.H. Yip, C.H.L. Kennard, G. Smith and E.J.O'Reilly, *Aust. J. Chem.*, **40,** 981 (1987).
456. W. Clegg, I.R. Little and B.P. Straughan, *Acta Crystallogr.*, Sect. C, **42,** 919 (1986).
457. W.T.A. Harrison, T.M. Nenoff, T.E. Gier and G.D. Stucky, *Inorg. Chem.*, **31,** 5395 (1992).
458. F. Giordano, C. Randaccio and A. Ripamonti, *Acta Crystallogr.*, Sect. B, **25,** 1057 (1969).
459. P. Fenot, J. Darriet, C. Garrigou-Lagrange and A. Cassaigne, *J. Mol. Struct.*, **43,** 49 (1978).
460. Y.Ch. Sinha, F.G. Kramarenko, T.I. Polynova, M.A. Poraj-Koshits and N.D. Mitrofanova, *Zh. Strukt. Khim.*, **16,** 144 (1975).
461. C.N. Morimoto and E.C. Linfafelter, *Acta Crystallogr.*, Sect. B, **26,** 335 (1970).
462. R. Lehnert and F. Seel, *Z. Anorg. Allg. Chem.*, **464,** 187 (1980).
463. G. Ciani, M. Moret, A. Sironi, S. Bruni, F. Cariati, A. Pozzi, T. Manfredini, L. Menabue and G.C. Pellaconi, *Inorg. Chim. Acta,* **158,** 9 (1989).
464. T. Aoyagi, H.M.M. Shearer, K. Wade and G. Whitehead, *J. Organometal. Chem.*, **146,** C29 (1978).
465. T. Ito, T. Igarashi and H. Hagihara, *Acta Crystallogr.*, Sect. B, **25,** 2303 (1969).
466. I.G. Dance, *J. Am. Chem. Soc.*, **102,** 3445 (1980).
467. M. Calligaris, A. Ciana, S. Meriani, G. Nardin, L. Randaccio and A. Ripamonti, *J. Chem. Soc.*, A, 3386 (1970).
468. S. Baggio, R.F. Baggio and P.K. De Perazro, *Acta Crystallogr.*, Sect. B, **30** 2166 (1974).
469. S.K. Miller, L.G. Marrilli, S. Dörre, P. Kollat, R.D. Stigler and J.J. Stezowski, *Inorg. Chem.*, **25,** 4272 (1986).
470. J.R. Amiraslanov, G.N. Nadzhafov, B.T. Usubaliev, A.A. Musaev, E.M. Movsumov and H.S. Mamedov, *Zh. Strukt. Khim.*, **21,** 140 (1980); I.R. Amiraslanov, H.S. Mamedov, E.M. Movsumov, G.N. Nadzhafov and F.N. Musaev, *Dokl. Akad. Nauk Azerb. SSR,* **35,** 50 (1979).
471. A.H. White and A.C. Willis, *J. Chem. Soc.*, Dalton Trans., 1372 (1977).
472. M.J. McCall and M.R. Taylor, *Acta Crystallogr.*, Sect. B, **32,** 1687 (1976).
473. T.W. Hambley and M.R. Snow, *Aust. J. Chem.*, **36,** 1249 (1983).
474. F.A. Mautner and Ch. Kratky, *Cryst. Res. Technol.*, **23,** 1477 (1988).
475. F.A. Mautner, H. Krischner and Ch. Kratky, *Z. Naturforsch.*, **43b,** 253 (1988).
476. A.M. Shachter, E.B. Fleischer and R.C. Haltiwanger, *J. Chem. Soc.*, Chem. Commun., 960, (1988).
477. C.T. Kiers and A. Vos, *Acta Crystallogr.*, Sect. B, **34,** 1499 (1978).
478. M.A. Jampolskaya, P.N. Bayrosh, Yu. A. Simonov and N.V. Gerbeley, *Zh. Neorg. Khim.*, **32,** 1655 (1987).
479. F. Bigoli, A. Braibanti, A. Tiripicchio and M. Tiripicchio Camellini, *Acta Crystallogr.*, Sect. B, **27,** 2453 (1971).
480. A. Boardman, R.W.H. Small and I.J. Worrall, *Acta Crystallogr.*, Sect. C, **39,** 1005 (1983).
481. M. Nagase, Y. Yukawa, Y. Inomata and T. Takeuchi, *Bull. Chem. Soc. Jpn.*, **61,** 775 (1988).
482. Y. Nakacho, T. Misawa, T. Fujiwara, A. Wakahara and K. Tomita, *Bull. Chem. Soc. Jpn.*, **49,** 595 (1976).
483. V. Shakeri and S. Haussühl, *Z. Kristallogr.*, **198,** 167 (1992).
484. N. Burger and H. Fuess, *Z. Kristallogr.*, **145,** 346 (1977).
485. W. Honghui, Z. Naijue, F. Heng, L. Ronechang and W. Kui, *Sc. Sin.*, Ser. B, **31,** 20 (1988).
486. I. Labadi, C. Bernat, L. Parkanyi, G. Kenessey and G. Liptay, *Polyhedron,* **11,** 2975 (1992).
487. N.J. Ray and B.J. Hathaway, *Acta Crystallogr.*, Sect. B, **38,** 770 (1982).
488. A.T. Reed and A. Karipides, *Acta Crystallogr.*, Sect. B, **32,** 2085 (1976).
489. A. Karipides, *Acta Crystallogr.*, Sect. C, **39,** 1541 (1983).
490. S. Tsuji, T. Shibata, Y. Ito, S. Fujii and K. Tomita, *Acta Crystallogr.*, Sect. C, **47,** 528 (1991).
491. T. Lis, *Acta Crystallogr.*, Sect. C, **48,** 424 (1992).
492. A. Weiss, E. Reigler, I. Alt, H. Böhme and Ch. Robl, *Z. Naturforsch.*, **41b,** 18 (1986).
493. A. Weiss, E. Riegler and Ch. Robl. *Z. Naturforsch.*, **41b,** 1329 (1986).
494. G. Smith, E.J. O'Reilly, C.H.L. Kennard and T.C.W. Mak, *Inorg. Chem.*, **24,** 2321 (1985).
495. K.J. Martin, P.J. Squattrito and A. Clearfield, *Inorg. Chim. Acta,* **155,** 7 (1989).
496. D.W. Engelfriet, W. den Brinker, G.C. Verschoor and S. Gorter, *Acta Crystallogr.*, Sect. B, **35,** 2922 (1979).
497. W.R. Scheidi, C.W. Eigenbrot, M. Ogiso and K. Hatano, *Bull. Chem. Soc. Jpn.*, **60,** 3529 (1987).
498. S.R. Batten, B.F. Hoskins and R. Robson, *J. Chem. Soc.*, Chem. Commun., 445 (1991).
499. F.A. Mautner, H. Krischner and Ch. Kratky, *Z. Kristallogr,* **172,** 291 (1985).

500. T. Doyne and R. Pepinsky, *Acta Crystallogr.*, **10,** 438 (1957).
501. L. Kryger and S.E. Rasmussen, *Acta Chem. Scand.*, **27,** 2674 (1973).
502. C.M. Gramaccioli, *Acta Crystallogr.*, **21,** 600 (1966).
503. P. Richard, D. Tran Qui and E.F. Bertaut, *Acta Crystallogr.*, Sect. B, **30,** 628 (1974).
504. A. Fuertes, C. Miravitlles, E. Eserivá, E. Coronado, D. Beltrán and L. Padel, *J. Chem. Soc.*, Dalton Trans., 863 (1989).
505. T.N. Polynova, T.V. Filippova, M.A. Poraj-Koshits, V.K. Belskij, A.N. Sobolev and L.I. Mjachina, *Koord. Khim.*, **14,** 405 (1988).
506. S. Fortier and K.A.M. Creber, *Acta Crystallogr.*, Sect. C, **41,** 1763 (1985).
507. J.C. Jansen, H. Van Koningsveld and J.A.C. van Ooijen, *Cryst. Struct. Comm.*, **8,** 499 (1979).
508. D. van der Helm, A.F. Nicholas and C.G. Fisher, *Acta Crystallogr.*, Sect. B, **26,** 1172 (1970).
509. F.S. Stephens, R.S. Vagg and P.A. Williams, *Acta Crystallogr.*, Sect. B, **33,** 433 (1977).
510. R.B. Wilson, P. de Meester and D.J. Hodgson, *Inorg. Chem.*, **16,** 1498 (1977).
511. D. van der Helm and H.B. Nicholas, Jr., *Acta Crystallogr.*, Sect. B, **26,** 1858 (1970).
512. A.E. Shvelashvili, R.I. Machhosvili, E.B. Miminoshvili, B.M. Schedrin, N.N. Vekua, A.I. Kvitashvili and E.A. Mikeladze, *Zh. Neorg. Khim.*, **25,** 1779 (1980).
513. N.W. Alcock, A. Berry and P. Moore, *Acta Crystallogr.*, Sect. C, **48,** 16 (1992).