Synthesis and Properties of Monoarylgold(III) Complexes

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Summary Monoarylgold(III) complexes have been prepared and characterised; their i.r. spectra show the strong *trans* influence of the aryl ligand.

UNTIL the recent reports of the synthesis of some pentafluorophenylgold(III) compounds[1] and of the salts[2]$[Et_4N][RAuCl_3]$ (R = Ph, p-MeC_6H_4) no stable aryls of gold(III) had been characterised. We now report the synthesis of a number of air stable dichloro(aryl)gold(III) complexes, $RAuCl_2L$ (R = Ph, p-MeC_6H_4, p-ClC_6H_4; L = SPr_2^n, PPh_3, PMe_3, py) obtained by addition of the ligand to the unstable product $(RAuCl_2)_2$ of the auration reaction[3] $RH + Au_2Cl_6 \rightarrow (RAuCl_2)_2 + 2HCl$ using freshly prepared anhydrous gold(III) chloride. Some of the pale yellow or colourless complexes we have characterised are shown in the Table. Those which are sufficiently soluble to allow molecular weight determinations are monomeric.

Thermal analysis studies of a series of p-tolyl complexes $MeC_6H_4AuCl_2L$ shows their thermal stability to decrease along the series L = PPh_3 > py > Cl^- > SPr_2^n, the PPh_3 complex undergoing no weight loss below 300°. A series of displacement reactions, $MeC_6H_4AuCl_2L + L' \rightarrow MeC_6H_4AuCl_2L' + L$ establishes the order of complexing power to be $PPh_3 > Cl^- > py > SPr_2^n$ which parallels a similar order of isomer shifts in the Mössbauer spectra[4] of the complexes $LAuCl_3$.

From i.r. data (Table) the phosphine and dipropylsulphide complexes are assigned the *cis* configuration, whereas the absence of a band in the pyridine complexes corresponding to νAu–Cl *trans* to the aryl group support their formulation as the *trans* isomer. The spectra illustrate the strong *trans* influence of the aryl group, the order of *trans* influence in these gold(III) complexes being aryl > PR_3 > SPr_2^n > Cl > py. *X*-ray crystallographic studies on some of these compounds are in progress.

TABLE

Melting points and i.r. spectra[a] (600—220 cm^{-1}) *of some monoarylgold compounds*[b]

Compound	m.p.	ν(Au–aryl)[c]	ν(Au–Cl)	ν(Au–Cl) *trans aryl*
$[Bu_4N][PhAuCl_3]$	100°	471m	365s 332w	280vs
cis-$PhAuCl_2SPr_2^n$	113—114°	476m	328m	294vs
cis-$PhAuCl_2PMe_2Ph$	126—127°	475m	310s	286s
trans-$PhAuCl_2py$	155 decomp.	478s	357s 355sh	
$[Bu_4N][p$-$MeC_6H_4AuCl_3]$	118—119°	488s	360sh 350s 330m	276vs
cis-p-$MeC_6H_4AuCl_2SPr_2^n$	94—95°	495s	327s 324sh	292vs
cis-p-$MeC_6H_4AuCl_2PPh_3Et_2O$	152—153°	494s	318s	288vs
trans-p-$MeC_6H_4AuCl_2py$	164° decomp.	495s	362s 355sh	

[a] Bands other than those assigned are omitted; [b] satisfactory analytical data were obtained in all cases; [c] corresponds to Whiffen's y mode.[5]

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