for anomalous dispersion were applied to the Rh, Cl, and P scattering curves.

Throughout the refinement, the phenyl rings were treated as rigid groups constrained with C–C = 1.392 Å, C–H = 1.00 Å, and all bond angles 120°, and with isotropic temperature factors for C varied individually while those for H were held fixed at 3.5 Å^2. Isotropic refinement omitting all nongroup H atoms approached convergence at R = 0.080 and R_w = 0.088. Anisotropic refinement was begun at this stage for all nongroup atoms, except the THF atoms which were always treated isotropically. When values of R = 0.066 and R_w = 0.071 were reached in the anisotropic refinement, unduly high thermal parameters for some of the carbons of the norphos ligand suggested the presence of disorder in this ligand. A difference density map, omitting the three carbons of the 1,2-ethylidene bridge and the methylene bridge of the norbornene ring system, revealed that these three carbons were each occupying two positions, related by a pseudo-two-fold axis approximately bisecting the P–Rh–P angle and approximately normal to the C5–C6 bond. Each of these six positions was described as being occupied by a half-weighted carbon atom, and these were treated isotropically in all subsequent refinement.[26]

So that the assignment of absolute configuration could be tested, the structure was at this point subjected to two parallel refinements, one for each of the possible enantiomers. With the use of coordinates describing the *S,S* structure, convergence was achieved at R = 0.052 and R_w = 0.056, while the *R,R* structure could be refined only to R = 0.054 and R_w = 0.059. A statistical interpretation of the R factor ratio using Hamilton's test[27] indicated that the *R,R* configuration for (+)-**15** could be rejected in favor of *S,S* at a confidence level far exceeding 99.5%. This result is consistent with the assignment by Brunner.[5]

At this stage, a difference density map contained peaks at all computed hydrogen positions,[28] including those of the disordered carbons. Hydrogens were included at these idealized positions and assigned isotropic temperature factors corresponding to the thermal motion of the carbons to which they were attached. Attempts to refine these hydrogen temperature factors resulted in unreasonable values, so these were held fixed at their initial values while positions were allowed to vary. Hydrogens on the THF molecule were also held fixed in their initial idealized positions. Final convergence of the refinement was obtained with R = 0.047 and R_w = 0.048. Inclusion of all reflections in a final structure factor calculation gave R = 0.062 and R_w = 0.048. A final difference density map contained only small peaks (<0.9 e Å^{-3}).

Final fractional crystallographic coordinates and anisotropic temperature factors for the nonhydrogen, nongroup atoms appear in Table IV. Rigid group parameters used to describe the phenyl rings are presented in Table V. Bond lengths, angles, and selected dihedral angles are contained in Table VI.

Observed and calculated structure factor amplitudes, final parameters for nongroup hydrogen atoms, and fractional crystallographic coordinates and temperature factors for the rigid group atoms and for the atoms in THF appear in supplementary tables.[26]

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Registry No. (−)-**2**, 71075-23-5; (−)-**3**, 71042-54-1; **4**, 55065-02-6; (−)-**11**, 78822-58-9; (−)-**12**, 78803-92-6; **13**, 12257-42-0; **14**, 32354-50-6; (−)-**15**-C_4H_8O, 78791-09-0; (+)-**16**, 78803-86-8; **17**, 5429-56-1; **19**, 97-65-4; **21**, 32799-34-1; (+)-**12**, 78803-93-7.

Supplementary Material Available: Tables of observed and calculated structure factor amplitudes (Supplementary Table I), anisotropic thermal parameters (Supplementary Table II), derived fractional coordinates for rigid atom groups (Supplementary Table III), and fractional coordinates and isotropic thermal factors for atoms in the tetrahydrofuran molecule (Supplementary Table IV) (26 pages). Ordering information is given on any current masthead page.

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Preparation and Characterization of Some Chromium(III) Complexes of the Forms [Cr(L- or D-asp)(L-his)] and [Cr(L-asp)$_2$]$^-$ (asp = Aspartate and his = Histidinate Ions)

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Mixed-ligand chromium(III) complexes of the form [Cr(L- or D-asp)(L-his)] and [Cr(L-asp)$_2$]$^-$ were prepared. Isolated isomers of each complex were assigned structures on the basis of their visible spectra and high-speed chromatograms. The CD spectra of the [Cr(L- or D-asp)(L-his)] complexes are similar to those of the [Co(L- or D-asp)(L-his)] complexes, permitting tentative structural assignments for three isomers of the [Cr(L-asp)$_2$]$^-$ complexes. The observed distribution of the isomers suggests that in these complexes, as well as in previously reported [Co(L- or D-asp)(L-his)] complexes, amino groups avoid being trans to each other.

Introduction

Only a few Cr(III) complexes containing bis(tridentate) amino acidate ligands have been prepared.[1-3] Though three geometrical isomers (*fac*-cis(N), *fac*-trans(N), and *mer*-trans(N)) are possible for the $Cr^{III}N_2O_4$ complexes coordinating bis(iminodiacetate) or bis((methylimino)diacetate) ligands, only one each has been prepared for the former complex, which exists as the cis(N) isomer, and for the latter complex, being trans(N). While three isomers have been prepared for the [Cr(L-asp)$_2$]$^-$ complexes, their geometrical configurations have not been assigned even tentatively because their UV and CD spectra resemble each other.[3]

We have reported so far preparations of the [Co(A)(B)] type complexes that take the form of $Co^{III}N_3O_3$, where A = L- or D-aspartate or iminodiacetate and B = L-histidinate, L-2,4-diaminobutyrate, or L-ornithinate.[4-11] Though every

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series has three isomers (two meridional and one facial), we could assign each isomer to a certain geometry by using mainly their ^1H NMR, UV, and CD spectra. These assignments were substantiated with an X-ray crystal study of one of the cobalt(III) complexes coordinating L-aspartate and L-ornithinate.[11]

Here we report the preparation and characterization of the mixed chromium complexes having L- or D-aspartate and L-histidinate, along with the refined preparation of the $[Cr(L\text{-}Asp)_2]^-$ complexes and their geometrical assignments. From the distribution of the isomers it becomes clear, in analogy with those for the Co(III) complexes, that amino groups avoid being trans to each other.

Experimental Section

Materials. L-Histidine and L- and D-aspartic acid were purchased from Tokyo-Kasei Co.

Isomers of [Cr(L-asp)(L-his)]. To a concentrated ammonia solution (7 mL) was added $K_2Cr_2(SO_4)_4 \cdot 24H_2O$ (10 g, 0.01 mol). The precipitate was centrifuged and suspended in 50 mL of water. To this suspension were added L-aspartic acid (0.01 mol) and L-histidine (0.01 mol). After the suspension was stirred and heated (ca. 80 °C) for 1 h, it was centrifuged and cooled to room temerature. One-fourth of this solution was loaded on a column (50 × 500 mm) of Sp-Sephadex C-25 strong cation resin which was in the sodium form. The column was eluted with water slowly. Three bands descended and were called C-1, C-2, and C-3. They were concentrated with a vacuum rotary evaporator below 10 °C. They were loaded again on a column (50 × 500 mm) of QAE-Sephadex A-25 anion resin, which was in the chloride form, and eluted with water. From the column containing C-1, a small amount of neutral species descended but was not the isomer desired. From the column loaded with C-2, only one band of neutral species descended and was concentrated to 20 mL with a rotary evaporator at less than 10 °C. After the sample was kept in a refrigerator, a small amount of red-violet precipitate appeared and was called CL1. From the column with C-3, only one band was eluted, which was concentrated to 10 mL below 10 °C and stored in a refrigerator. Red crystals appeared and were called CL3 (the reason that it was not called CL2 is given later).

Isomers of [Cr(D-asp)(L-his)] were obtained by the method described above using D-aspartic acid instead of L-aspartic acid and were called CD1 and CD3 in order of elution.

Anal. Calcd for $[CrC_{10}H_{13}N_4O_6] \cdot 4.5H_2O$: C, 28.71; H, 5.30; N, 13.39. Found (CL1): C, 28.44; H, 5.10; N, 13.41. Calcd for $[CrC_{10}H_{13}N_4O_6] \cdot 2H_2O$: C, 30.69; H, 4.90; N, 14.30. Found (CL3): C, 30.25; H, 4.53; N, 14.25. Calcd for $[CrC_{10}H_{13}N_4O_6] \cdot 2.5H_2O$: C, 31.42; H, 4.74; N, 14.65. Found (CD1): C, 31.28; H, 4.81; N, 14.88. Calcd for $[CrC_{10}H_{13}N_4O_6] \cdot 2H_2O$: C, 32.18; H, 4.59; N, 15.01. Found (CD3): C, 31.90; H, 4.74; N, 15.21.

Isomers of $[Cr(L\text{-}asp)_2]^-$. While the preparation of the isomers of the $[Cr(L\text{-}asp)_2]^-$ complexes has been reported, we refined the method, because the products were considered to be mixtures of the possible isomers. To a solution of 50 mL containing L-aspartic acid (2.7 g, 0.02 mol) was added a solution of 0.01 mol of chromium trichloride. After the solution was heated at 80 °C for 10 min, the pH of the solution was adjusted to 5.0–5.5. After the solution was heated and stirred for 1 h, it was cooled to room temperature and loaded on a column containing QAE-Sephadex A-25 anion resin in chloride form (50 × 500 mm). Any uncharged or cationic species produced in reaction were washed from the column with 200 mL of water. Separation of the Cr(III) complexes was achieved by eluting with 0.1 M NaCl at rate of 1 drop/5 s. Five colored bands descended, and all were red-violet. Each band was frozen and evaporated by using a freeze-dryer. Each solid containing NaCl was dissolved in 10 mL of water. Each solution was desalted by using a column (50 × 500 mm) containing Sephadex G-25 Gel resin. These UV spectra and the results of elemental analysis showed that the second, third, and fourth bands were the desired complexes, which were called respectively B, C, and D in order of elution.

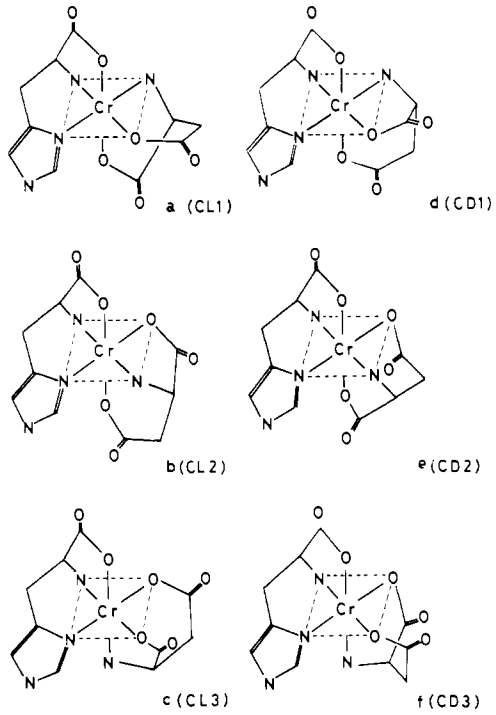

Figure 1. The six possible isomers of [Cr(L- or D-asp)(L-his)]: (a) L-trans(O_5),cis(N_5); (b) L-cis(O_5),trans(N_5); (c) L-*fac*; (d) D-cis(O_5),cis(N_5); (e) D-trans(O_5),trans(N_5); (f) D-*fac*. The isomers obtained were tentatively assigned and are shown in parentheses.

Anal. Calcd for $Na[CrC_8H_{10}N_2O_8] \cdot 3H_2O$: C, 24.56; H, 4.12; N, 7.16. Found (B): C, 23.20; H, 4.40; N, 6.54. Found (D): C, 23.76; H, 3.80; N, 7.02. Calcd for $Na[CrC_8H_{10}N_2O_8] \cdot 3.5H_2O$: C, 24.00; H, 4.28; N, 7.00. Found (C): C, 23.50; H, 3.80; N, 7.02.

Spectra. Visible and circular dichroism spectra were measured with a Jasco J-20 spectrophotometer in aqueous solution. High-speed liquid chromatograms were obtained by using a column containing a strong cation-exchange resin, TSK LS-212 Toyo Soda Ind., Na form. The separation was achieved by using water as eluant.

Results and Discussion

Figure 1 shows the possible isomers of the [Cr(L- or D-asp)(L-his)] complexes. They are denoted by L or D series with respect to the asp used. Both series of mixed complexes are composed of two meridional and one facial isomers, $[CrN_3O_3]$. The two L-*mer* isomers are denoted by L-trans(O_5),cis(N_5) (oxygen atoms of the five-membered chelate rings are trans with each other and those of nitrogen atoms are cis with each other) and L-cis(O_5),trans(N_5). The three [Cr(L-asp)(L-his)] isomers (L-trans(O_5),cis(N_5), L-cis(O_5),trans(N_5), and L-*fac*) are related by an imaginary twist through 120° of one coordinated ligand relative to the other about an axis passing through the two ligands occupying triangular faces of the chromium(III) coordination octahedron. The same kind of relationship exists for the three isomers containing coordinated D-aspartate ion.

Assignment of the [Cr(L- or D-asp)(L-his)] Isomers. Since the two neutral complexes for each series exhibit electronic absorption spectra (Figure 2) that agree with the crystal field consideration that the first absorption band of a facial isomer has smaller splitting than that for a meridional isomer, it is possible to assign the *mer* geometry to CL1 and CD1 and *fac* geometry to CL3 and CD3. It is of significance to determine to which geometry the two *mer* isomers (CL1 and CD1) can be assigned. High-speed liquid chromatograms for L or D series are given in Figure 3 together with those for [Co(L- or D-

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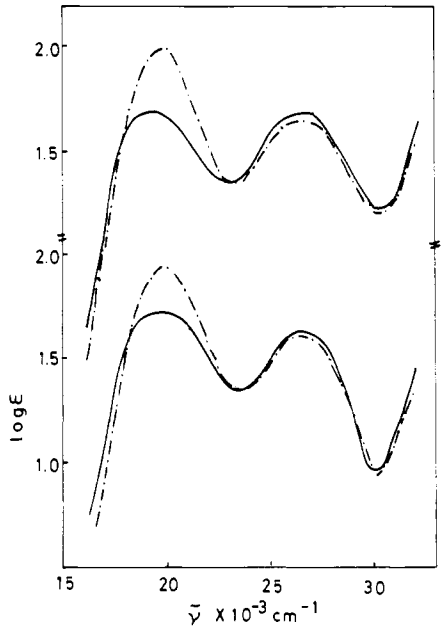

Figure 2. Visible absorption spectra of [Cr(L- or D-asp)(L-his)]: upper, CL1 (—) and CL3 (-·-); lower, CD1 (—) and CD3 (-·-).

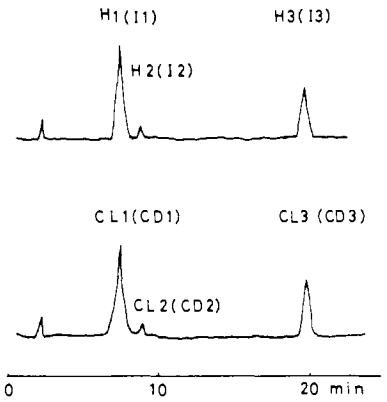

Figure 3. High-speed liquid chromatograms indicating the mixture of [Co(L- or D-asp)(L-his)] (upper) and those of [Cr(L- or D-asp)-(L-his)] (lower). The amount of CD2 is traced.

asp)(L-his)]. The chromatograms of the mixed solution containing C-2 and C-3 showed three peaks for each series except for a marker. The first peak corresponded to that for CL1 and the third to that for CL3. The second peak is considered to be the other *mer* isomer desired since it lies at the same position as that for H2 isomer of the [Co(L-asp)(L-his)] complexes. The similarity of the band positions and the relative concentration ratios of the [Cr(L- or D-asp)(L-his)] complexes with those for the [Co(L- or D-asp)(L-his)] complexes is particularly surprising. In our chromatography the elution order of the complexes is considered to correspond to the reverse order of the magnitudes of the dipole moments of these complexes. We therefore tentatively assigned the geometrical configuration to the isomers prepared as below: CL1 to L-trans(O_5),cis(N_5), CL2 to L-cis(O_5),trans(N_5), and CL3 to L-*fac*.

By the same consideration, CD1 may be assigned to D-cis-(O_5),cis(N_5), CD2 to D-trans(O_5),trans(N_5), and CD3 to D-*fac*. There is no discrepancy between the assignments by high-speed chromatograms and UV–visible spectra. Because of the low proportions of the CL2 (CD2) isomer and the difficulty of their isolation from the mixture of two *mer* isomers by Sephadex chromatography, we could not obtain pure CL2 and CD2 isomers. Though the CL1 and CD1 isomers crystallized from the C-1 eluate, the amount of the CL2 (CD2) isomer gradually decreased owing to isomerization.

Figure 4 shows CD spectra of [Cr(L- or D-asp)(L-his)] compared with those of the corresponding [Co(L- or D-asp)(L-his)] complexes. In Figure 4a, which shows CD spectra of the CL1 and H1 isomers, there seem to be three peaks (ca. 19, 22, and 28 × 10^3 cm^{-1}) in the absorption region outside of the charge-transfer band. Two of the three peaks in this region have positive signs (at 22 and 28 × 10^3 cm^{-1}) for both CL1 and H1 while the peaks at 19 × 10^3 cm^{-1} for CL1 and H1 have opposite signs. In Figure 4b, which shows CD spectra of the CL3 and H3 isomers, the signs and the shapes of the three peaks outside the charge-transfer band region resemble each other though the CD peak intensities of the CL3 isomer are slightly lower than the corresponding peaks of the H3 isomer. In Figure 4c, which shows CD spectra of CD1 and I1 isomers, only two peaks outside the charge-transfer region are recognizable for the CD spectrum of the CD1 isomer of [Cr(D-asp)(L-his)] while three peaks (19, 22, and 29 × 10^3 cm^{-1} are found for that of I1 isomer of [Co(D-asp)(L-his)]. When these two CD spectra are compared, two peaks (ca. 19 and 22 × 10^3 cm^{-1}) for each complex have negative and positive signs from the lower energy side in the first absorption band to the second absorption band though these intensities greatly vary. In Figure 4d, which shows CD spectra of CD3 and I3 isomers, the two negative peaks (ca. 21 and 28 × 10^3 cm^{-1}) of CD3 are found in the absorption region outside the charge-transfer-band region, corresponding to the negative peaks (21 and 28 × 10^3 cm^{-1}) of I3 though I3 has one more negative peak at 18 × 10^3 cm^{-1}.

In the charge-transfer-band region, two CD peaks appear in all cases of the [Cr(L- or D-asp)(L-his)] complexes, while one peak appears for all the [Co(L- or D-asp)(L-his)] complexes. Accordingly, no similarity in this region is found between the CD spectra of the [Cr(L- or D-asp)(L-his)] complexes and those of the [Co(L- or D-asp)(L-his)] complexes. In conclusion, comparison of the CD spectra for both the Cr(III) and the Co(III) complexes shows their shapes and signs are similar only between the higher energy side of the first-absorption-band region and the second-absorption-band region (ca. (20–30) × 10^3 cm^{-1}).

Isomers of $[Cr(L\text{-}asp)_2]^-$. Generally, the assignment of isomers of the Co(III) complexes containing optically active tridentate amino acids by means of CD spectra is known to be difficult.[12,13] Yamada et al.[13] have reported the preparation of the three isomers of the $[Co(L\text{-}asp)_2]^-$ complexes. Oonishi has reported the X-ray crystal study of one of these three isomers.[14] The three isomers of $[Co(L\text{-}asp)_2]^-$ have been assigned in order of elution as trans(N), cis(N_5),trans(O_5), and cis(N_5),trans(O_6) isomers, respectively.

Witte et al.[3] have reported the preparation and UV and CD spectra of the corresponding Cr(III) complexes, but they could not assign these isomers to their geometries (Figure 5). According to their results, the CD and UV spectra of the three isomers resembled each other. We also prepared the above complexes with caution, especially with regard to the evaporating temperature and method of desalting. A freeze-dryer was used when the eluates of the isomers were evaporated. Figure 6 shows the absorption spectra of the $[Cr(L\text{-}asp)_2]^-$ complexes.

Generally, the trans(N) isomer of the $[MN_2O_4]$ type has greater splitting and the lower intensity in the first absorption band than do the cis(N) isomers. The ratio of the peak heights (log ϵ) of the first absorption bands to those of the second

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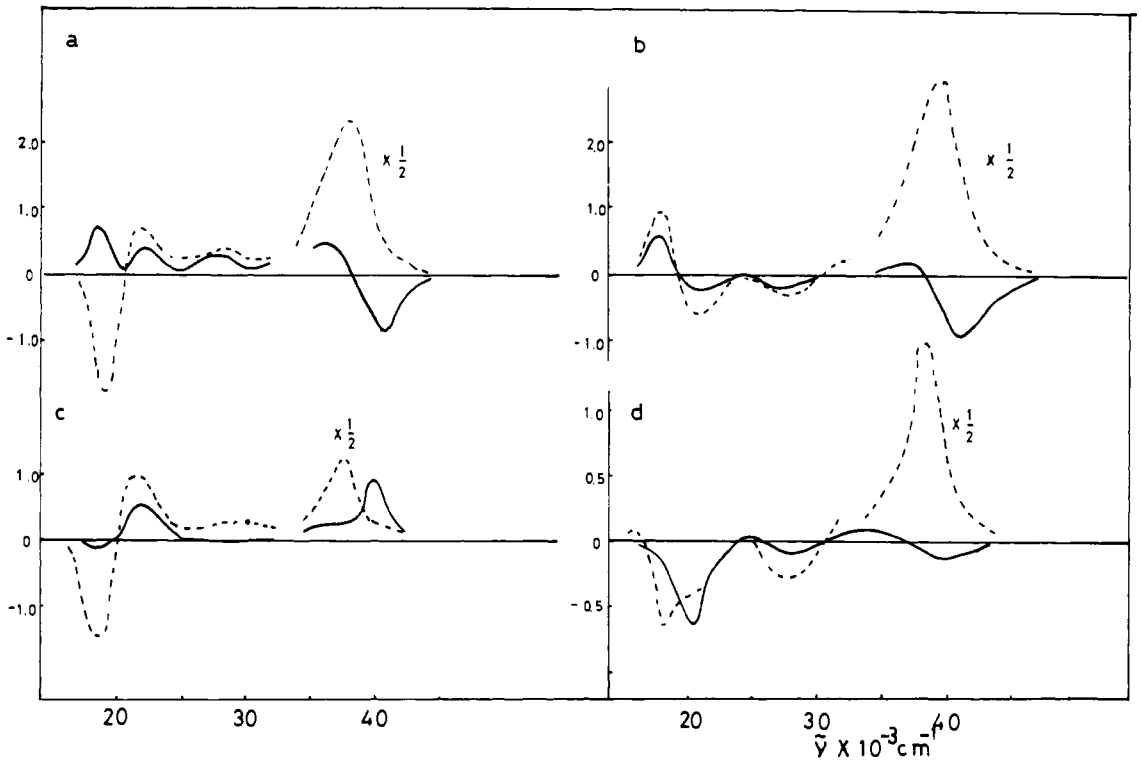

Figure 4. CD spectra of [Cr(L- or D-asp)(L-his)] (—) and [Co(L- or D-asp)(L-his)] (---): (a) L-trans(O_5),cis(N_5) (CL1 and H1); (b) L-*fac* (CL3 and H3); (c) D-cis(O_5),cis(N_5) (CD1 and I1); (d) D-*fac* (CD3 and I3).

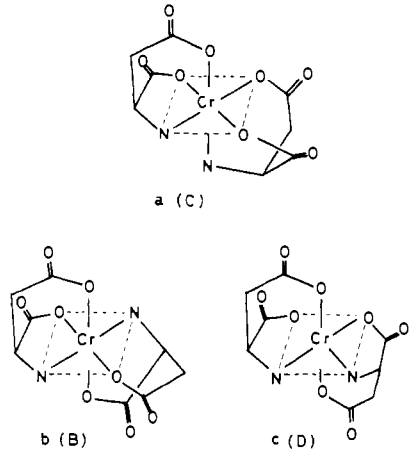

Figure 5. Isomers of $[Cr(L\text{-}asp)_2]^-$: (a) cis(N_5),trans(O_5); (b) trans(N_5); (c) cis(N_5),trans(O_5). The isomers obtained were tentatively assigned and are shown in parentheses.

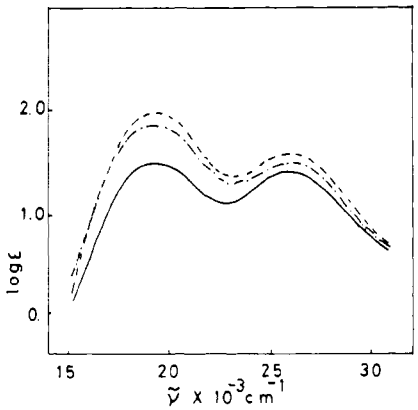

Figure 6. Visible absorption spectra of $[Cr(L\text{-}asp)_2]^-$: B (—); C (---); D (-·-).

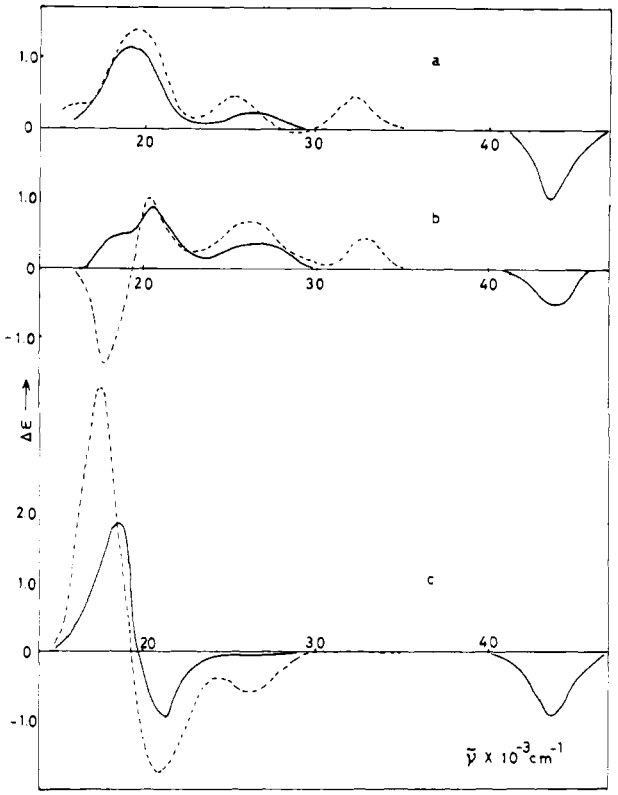

Figure 7. CD spectra of $[Cr(L\text{-}asp)_2]^-$ (—) and those for $[Co(L\text{-}asp)_2]^-$ (---): (a) B and F isomers; (b) C and S isomers; (c) D and T isomers.

bands are 1.14 for B, 1.27 for C, and 1.28 for D. Though the splitting of the peak of B in the first-absorption-band region is not so clearly distinguishable as trans(N), since the ratio for B is smallest of the three, B seems to be the trans(N) isomer, and C and D appear to be the cis(N) isomers. Further evidence for this argument is given by the analogy of the order

Table I. Product Yields in Preparation of [M(L- or D-asp)(L-his)] and $[M(L\text{-asp})_2]^-$ (M = Cr, Co)

	[Co(L-asp)-(L-his)]	[Cr(L-asp)-(L-his)]
trans(O_5),cis(N_5)	0.53	0.61
cis(O_5),trans(N_5)	0.06	0.02
L-*fac*	0.41	0.37
	[Co(D-asp)-(L-his)]	[Cr(D-asp)-(L-his)]
cis(O_5),cis(N_5)	0.48	0.58
trans(O_5),trans(N_5)	0.01	trace
D-*fac*	0.51	0.42
	$[Co(L\text{-asp})_2]^-$	$[Cr(L\text{-asp})_2]^-$
trans(N_5)	0.26	0.33
cis(N_5),trans(O_5)	0.47	0.40
cis(N_5),trans(O_5)	0.27	0.27

of elution and the elution intervals among Cr(III) complexes with those for Co(III) complexes.

For the case of Cr(III) complexes having these ligands, difficulty of characterization arises since no information is obtainable from their ^1H NMR spectra. By comparing the CD spectra of the [Cr(L- or D-asp)(L-his)] complexes with those of the [Co(L- or D-asp)(L-his)] complexes, we found a similarity in their CD spectra between the second-absorption-band region and the higher energy side of the first-absorption-band region. This similarity must serve for the characterization of the isomers of $[Cr(L\text{-asp})_2]^-$. Figure 7a shows that the first eluate (B) of the Cr(III) complexes has one CD peak in the first absorption region and one in the second absorption region, while the first eluate isomer (F) of the Co(III) complexes has two peaks in the first absorption region. In comparison of these two CD spectra between the higher energy side region of the first absorption and the second absorption region, the sign (positive at 20 and 27 × 10^3 cm^{-1}) is found to be the same. As is shown in Figure 7b the second eluate isomer(C) of the Cr(III) complexes has two positive peaks in the first-absorption-band region and one positive in the second-absorption-band region. On the other hand, three peaks (negative, positive, positive in order of energy increase) appear for the second eluate of $[Co(L\text{-asp})_2]^-$. Good agreement concerning their signs are obtained between the higher energy side of the first-absorption-band region and the second absorption band. For both of the third eluates (Figure 7c), similarity of those CD spectra seems to exist in the whole region outside the charge-transfer-band region, though the intensity of the CD spectrum of the third eluate D isomer of the $[Cr(L\text{-asp})_2]^-$ complexes at the second-absorption-band region is slightly smaller than that for the third isomer of the $[Co(L\text{-asp})_2]^-$ complexes. Therefore the similarity of the CD spectra between the higher energy side of the first-absorption-band region and the second-absorption-band region may be used to assign isomer B as trans(N_5),cis(O_5), isomer C as cis(N_5),trans(O_5), and isomer D as cis(N_5),trans(O_6).

In comparison of the CD spectra of the $[Cr(L\text{-asp})_2]^-$ complexes with those of the $[Co(L\text{-asp})_2]^-$ complexes in the charge-transfer region, surprisingly great differences are seen in their peak maxima and their signs.

Distributions of the isomers obtained here are listed in Table I together with those of the corresponding Co(III) complexes. The distributions of the [Cr(L- or D-asp)(L-his)] complexes are quite similar to those of the [Co(L- or D-asp)(L-his)] complexes and indicate that factors affecting the instabilities of these complexes such as steric hindrance and/or electronic effects are similar for both metal ions.

Registry No. CL1, 78685-02-6; CD1, 78685-03-7; CL3, 78638-59-2; CD3, 78684-38-5; B, 78684-39-6; C, 78656-76-5; D, 78684-40-9.

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Reaction of Metallocene Dichlorides of Titanium(IV) and Zirconium(IV) with Lithium Bis(trimethylsilyl)amide

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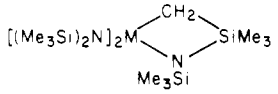
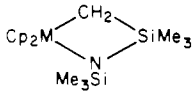
Reaction of Cp_2TiCl_2 with 1 or 2 molar equiv of $LiN(SiMe_3)_2$ yields the previously described metallacycle $Cp_2TiCH_2SiMe_2NSiMe_3$. Mass balance shows that for each mole of metallacycle formed, 1 molar equiv of hydrogen chloride is also formed. The related zirconium metallacycle was prepared from $Cp_2Zr(H)(Cl)$ and $LiN(SiMe_3)_2$. The bis(silylamide) of zirconium, $Cp_2Zr[N(SiMe_3)_2]_2$, was prepared from Cp_2ZrCl_2 and 2 molar equiv of $LiN(SiMe_3)_2$. The Me_3Si groups in the latter compound are magnetically nonequivalent at 27 °C but coalesce at 84 °C on the ^1H NMR time scale.

The four-membered-ring heterocyclic molecules (I) have



I, M = Zr, Hf, Th, U



II, M = Ti, Zr

been prepared recently by γ elimination of methane from the tris(silylamido) alkyls as shown in eq 1.[1] A related metallacycle II, M = Ti, was isolated some years ago in the reaction of dicyclopentadienyltitanium dichloride and 2 molar equiv of lithium bis(trimethylsilyl)amide.[2] It was implicitly suggested that the γ-hydrogen atom of a bis(trimethylsilyl)amido group in hypothetical $Cp_2Ti[N(SiMe_3)_2]_2$ was eliminated as $(Me_3Si)_2NH$, since the latter molecule was detected. Later, an explicit mechanism was proposed that suggested lithium bis(trimethylsilyl)amide deprotonates a γ-methyl group of the coordinated silylamide ligand in hypothetical $Cp_2Ti[N(SiMe_3)_2](Cl)$, yielding $Li\{Cp_2Ti[N(SiMe_3)(SiMe_2CH_2)](Cl)\}$ and $(Me_3Si)_2NH$. The former ion pair then eliminates lithium chloride, yielding II, M = Ti.[3a] To confuse the matter further,

$$[(Me_3Si)_2N]_3MMe \xrightarrow{\Delta} I + MeH \qquad (1)$$

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