Stable Silylmethyl and Neopentyl Complexes of Scandium(III) and Yttrium(III)

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Summary The complexes $(Me_3M'CH_2)_3M{\cdot}2THF$ (M = Sc or Y; M′ = C or Si) and $(o\text{-}MeOC_6H_4SiMe_2CH_2)_3Sc$ have been isolated from the reaction of the appropriate lithium reagent with MCl_3 or $MCl_3{\cdot}nTHF$.

THERE are no well-defined binary alkyls of the lanthanides.[1] The reactions of the Group IIIA trichlorides, MCl_3 (M = Sc, Y, La), with methyl-lithium have been investigated but the products $[Me_3M]$, could not be freed from lithium or chloride impurities.[2] A sterically-crowded tetra-aryl-lanthanide complex $[Li(THF)_4][Lu(C_6H_3Me_2\text{-}2,6)_4]$, has recently been characterised.[3]

We have prepared trimethylsilylmethyl and neopentyl complexes of scandium and yttrium, $(Me_3M'CH_2)_3M{\cdot}2THF$ (M = Sc or Y; M′ = C or Si) by reaction of the appropriate lithium reagent with either the anhydrous metal chloride in hexane–ether–tetrahydrofuran (THF), or $MCl_3{\cdot}nTHF$ in hexane–ether mixtures at *ca.* 0°. The complexes were obtained as analytically-pure, air-sensitive, colourless, crystals (*X*-ray studies are in hand) from n-pentane (Table). In the ^1H n.m.r. spectra, the methylene hydrogens of the yttrium complexes show coupling with ^{89}Y; yttrium is a rare example of a monoisotopic element having nuclear spin $I = \frac{1}{2}$.

The n.m.r. data are consistent with a trigonal bipyramidal arrangement of ligands around the metal, the THF molecules occupying axial sites. The unusual five-co-ordination may be favoured by the rather bulky $Me_3SiCH_2^-$ ligands.

TABLE. *Scandium and yttrium alkyls*

Compound	M.p.	$\nu(MC_3)$ cm^{-1}[a]	N.m.r. (τ)[b] CH$_2$	Me
$(Me_3CCH_2)_3Sc{\cdot}2THF$[c]	66—68°	515	9·38	8·63
$(Me_3SiCH_2)_3Sc{\cdot}2THF$[c]	62—63°	450	10·27	9·72
$(Me_3CCH_2)_3Y{\cdot}2THF$[c]	78—79°	490	10·07[d]	8·68
$(Me_3SiCH_2)_3Y{\cdot}2THF$[c]	48–50°	410	10·65[d]	9·65
$(o\text{-}MeOC_6H_4SiMe_2CH_2)_3Sc$	115—120° (decomp.)	480	9·92	9·45

[a] Broad bands [*cf.*, 470 cm^{-1} in $(Me_3SiCH_2)_4Ti$, M. R. Collier, M. F. Lappert, and R. Pearce, *J.C.S. Dalton*, 1973, in the press]; [b] in C_6H_6 (2·73 τ); [c] ν(C–O–C), 1020—1025 cm^{-1} (sharp) [d] doublet, $J(^{89}YCH^1H)$ 2·5 Hz.

The co-ordinated THF could not be removed *in vacuo*, but by the use of the more bulky, and possibly chelating, ligand $o\text{-}MeOC_6H_4SiMe_2CH_2$–, we have obtained a THF-free complex $(o\text{-}MeOC_6H_4SiMe_2CH_2)_3Sc$ (Table).

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