

insertion (chain growth) versus β -elimination (chain transfer) are apparently very different in the two oxidation states, favoring the former with Cr^{III} compounds and the latter for Cr^{II} alkyls. An obvious explanation for this difference lies in the superior stabilization of coordinated olefin by the more electron rich d^4 ion due to back-bonding. Our results clearly suggest that trivalent chromium is responsible for the polymerization activity of chromium-based catalysts. Further experiments in this area will be designed to elucidate the factors that govern the critical properties of the polymer (i.e., molecular weight, dispersity, branching, etc.).

A Look Ahead

We have shown that a wide variety of chromium(III) alkyls can be prepared and that such molecules are highly reactive. The chromium-carbon bonds in these compounds appear to be fairly polar, and the complexes are very Lewis acidic. As a result of this character, insertion reactions with unsaturated organic molecules as well as intramolecular C-H activation processes are very facile.

Where to go from here? Somewhat surprisingly, hydrogen does not react with many of the alkyl complexes, even under forcing conditions. Thus the preparation of chromium(III) hydrides and the study of their reactivity remain a challenge for the future. Similarly the exploration of the organometallic chem-

istry of chromium in oxidation states even higher than III remains to be tackled. Finally, an area in which we have some promising preliminary results concerns the question of chromium-carbon multiple bonds (i.e., alkylidenes and alkylidynes). Several of the compounds mentioned throughout this Account catalyze the ring opening metathesis polymerization (ROMP) of norbornene,⁴³ hinting of the accessibility of a chromium alkylidene complex. The isolation and characterization of such molecules is anticipated.

Paramagnetic organometallic compounds and their chemistry remain a challenging field of study. For the element chromium, such molecules may well be more relevant to catalytic reactions than their diamagnetic 18-electron counterparts. We are continuing our exploration. Stay tuned!

I thank the National Science Foundation and the donors of the Petroleum Research Fund, administered by the American Chemical Society, for supporting this research. None of it would have been possible without the curiosity and hard work of several undergraduate (S.-W. Hsu and N. H. Fredd), graduate (D. S. Richeson, B. J. Thomas, and R. A. Heintz), and postdoctoral students (Dr. S. K. Noh).

(43) Calderon, N. *J. Macromol. Sci., Rev. Macromol. Chem.* **1972**, C7(1), 105. Katz, T. J.; Lee, S. J.; Shippey, M. A. *J. Mol. Catal.* **1980**, *8*, 219. Gilliom, L.; Grubbs, R. H. *J. Am. Chem. Soc.* **1986**, *108*, 733. Wallace, K. C.; Schrock, R. R. *Macromolecules* **1987**, *20*, 450. Schrock, R. R.; Feldman, J.; Cannizzo, L. F.; Grubbs, R. H. *Macromolecules* **1987**, *20*, 1172.

Additions and Corrections

Vol. 22, 1989

Robert D. Guthrie* and William P. Jencks: IUPAC Recommendations for the Representation of Reaction Mechanisms.

Page 346, column 2. The word electrofugic on the line above eq 2 should be replaced by the word nucleofugic.