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Final Report

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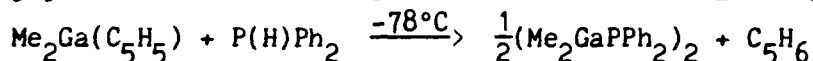
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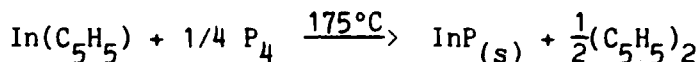
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Final Report

During the course of this contract, two very significant advances in our understanding of the formation of bonds between group 13 and group 15 elements have been achieved. (1) The substituents bonded to the group 13 element can have a dramatic effect on the ease of the elimination reaction with group 15 bases having acidic protons. Our experiments demonstrated that  $\text{Me}_2\text{Ga}(\text{C}_5\text{H}_5)$  reacts with  $\text{P}(\text{H})\text{Ph}_2$  at  $-78^\circ\text{C}$  to form  $[\text{Me}_2\text{GaPPh}_2]_2$ , whereas



$\text{GaMe}_3$  requires temperatures of  $160^\circ\text{C}$  to form the identical gallium-phosphorus product. (2) Indium(I) compounds react with elemental phosphorus ( $\text{P}_4$ ) at the remarkably low temperature of  $175^\circ\text{C}$  to form  $\text{InP}$ . Both of these



Scientific advances have provided the bases for applications for United States patents and have provided the background necessary to develop new precursors for deposition of group 13-15 materials, hopefully of electronic quality. *precursors: Group 13 compounds, Group 15 compounds, organometallic*

A second fundamental aspect of this research has been the preparation and complete characterization of a variety of new compounds. The new compounds include  $[(\text{Me}_3\text{CCH}_2)_2\text{InPPh}_2]_3$ ,  $[(\text{Me}_3\text{CCH}_2)_2\text{GaPPh}_2]_2$ ,  $[(\text{Me}_3\text{CCH}_2)_2\text{InCH}_2\text{PPh}_2]_2$ ,  $[(\text{Me}_3\text{CCH}_2)_2\text{GaCH}_2\text{PPh}_2]_2$ ,  $[\text{Me}_2\text{GaPPhMe}]_3$ ,  $[\text{Me}_2\text{GaN}(\text{H})(\text{C}_6\text{H}_{12})]_2$ ,  $[(\text{Me}_3\text{CCH}_2)(\text{Cl})\text{GaPPh}_2]_3$ ,  $[(\text{Me}_3\text{CCH}_2)(\text{Cl})\text{InPPh}_2]_3$ ,  $[(\text{Me}_3\text{CCH}_2)\text{Ga}(\text{PPh}_2)_2]_2$ ,  $\text{In}(\text{C}_5\text{Me}_5)$ ,  $\text{In}(\text{C}_5\text{H}_4\text{Me})$ ,  $\text{In}(\text{C}_5\text{H}_4\text{CMe}_3)$ ,  $\text{In}(\text{C}_5\text{H}_4\text{SiMe}_3)$ ,  $\text{In}(\text{C}_5\text{H}_4\text{GeMe}_3)$  and  $(\text{Me}_3\text{CCH}_2)_3\text{Ga}\cdot\text{P}(\text{H})\text{Ph}_2$ . These compounds have enabled us to begin to understand the chemistry of compounds with bonds between group 13 and 15 elements. However, many questions remain to be answered. Without doubt, this basic research is enabling us to predict, prepare and then utilize new precursors for the formation of group 13-15 materials.

Technical Reports

1. Synthesis of Tris(pentamethylcyclopentadienyl)gallium(III), O. T. Beachley, Jr.\* and R. B. Hallock, *Organometallics* 1987, 6, 170-172.
2. Chemistry of Methylgallium(III) Compounds in Protic Solvents, O. T. Beachley, Jr.\*, R. U. Kirss, R. J. Bianchini, and T. L. Royster, *Organometallics* 1987, 6, 724-727.
3. Synthesis and Characterization of Mesitylgallium Chloride Compounds Including the Crystal and Molecular Structure of Dichloromesitylgallium(III), an Inorganic Polymer, O. T. Beachley, Jr.\*, M. R. Churchill, J. C. Pazik, and J. W. Ziller, *Organometallics* 1987, 6, 2088-2093.
4. Synthesis and Characterization of Amphoteric Ligands Including the Crystal and Molecular Structure of  $[(\text{Me}_2\text{SiCH}_2)_2\text{InPPh}_2]_2$ , O. T. Beachley, Jr.\*, J. P. Kopasz, H. Zhang, W. E. Hunter, and J. L. Atwood, *J. Organomet. Chem.* 1987, 325, 69-81.
5. Synthesis and Characterization of Neopentylaluminum Compounds, O. T. Beachley, Jr.\* and L. Victoriano, *Organometallics* 1988, 7, 63-67.
6. Synthesis, Characterization and Structural Studies of  $\text{In}(\text{C}_5\text{H}_5\text{Me})$  by X-Ray Diffraction and Electron Diffraction Techniques and a Reinvestigation of the Crystalline State of  $\text{In}(\text{C}_5\text{H}_5)$  by X-Ray Diffraction Studies, O. T. Beachley, Jr.\*, J. C. Pazik, T. E. Glassman, M. R. Churchill, J. C. Fettinger, and R. Blom, *Organometallics* 1988, 7, 1051-1059.
7. Synthesis and Characterization of Neopentylgallium Compounds, O. T. Beachley, Jr.\* and J. C. Pazik, *Organometallics* 1988, 7, 1516-1519.
8. Pentamethylcyclopentadienyl-indium(I) and -indium(III) Compounds - Syntheses, Reactivities and X-Ray Diffraction and Electron Diffraction Studies of  $\text{In}(\text{C}_5\text{Me}_5)$ , O. T. Beachley, Jr.\*, R. Blom, M. R. Churchill, K. Faegle, Jr., J. C. Fettinger, J. C. Pazik, and L. Victoriano, *Organometallics* 1989, 8, 346-356.
9. The Chemistry of Mesitylgallium(III) Derivatives as Arene Ligands in Metal Carbonyl Complexes. Crystal and Molecular Structures of  $[(\text{CO})_2\text{Mo}(\eta^5\text{-C}_5\text{Me}_5)_2\text{Ga}(\text{C}_6\text{Me}_6\text{H}_2)]_2$  and  $[(\text{CO})_2\text{Mo}(\eta^5\text{-C}_5\text{Me}_5)_2\text{Ga}(\text{C}_6\text{Me}_6\text{H}_2)]_2\text{Ga}(\text{C}_6\text{Me}_6\text{H}_2)$ , O. T. Beachley, Jr.\*, T. L. Royster, Jr., Wiley J. Youngs, E. A. Zarate, and C. A. Tessier-Youngs, *Organometallics* 1989, 8, 1679-1688.
10. Indium(III) Compounds Containing the Neopentyl Substituent,  $\text{In}(\text{CH}_2\text{CMe}_3)_3$ ,  $\text{In}(\text{CH}_2\text{CMe}_3)_2\text{Cl}$ ,  $\text{In}(\text{CH}_2\text{CMe}_3)\text{Cl}_2$  and  $\text{In}(\text{CH}_2\text{CMe}_3)_2\text{Me}$ . The Crystal and Molecular Structure of Dichloroneopentylindium(III), an Inorganic Polymer, O. T. Beachley, Jr.\*, E. F. Spiegel, J. P. Kopasz, and R. D. Rogers, *Organometallics* 1989, 8, 1915-1921.

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