The Synthesis and Characterization of Novel Heteroleptic Alkaline Earth Metal Compounds

Cousins, Marina (School: Manlius-Pebble Hill School)

Metal Organic Chemical Vapor Deposition (MOCVD) precursors have properties that are beneficial in creating mixed-metal electronic thin-film materials such as ferroelectric SrBi2Ta2O9 and superconducting Bi2Sr2CaCu2Ox. Optimal MOCVD precursors are volatile at a low temperature and sublime cleanly to transport metals to form the thin film. Earlier work on the pyrazole (tBu2pzH) and 1,1,1,3,3,3-hexafluroro-2-phenyl-2-propanol (H(HFPP)) has shown that it is suitable for making volatile alkaline earth metal compounds as potential precursors for MOCVD applications. This contributed to the exploration of structural patterns in heavy alkaline earth metal chemistry, as the large metals and the weak metal–ligand bonding afford a variety of structural properties. Previous work in the Ruhlandt lab isolated novel homoleptic Ae pyrazolate compounds such as [Sr4(tBu2pz)8] and Ae tetraarylborate compounds such as [Ca(B((3,5-Me2)C6H3)4)2]. Therefore, it was successfully proposed that reacting the pyrazole and tetraarylborate ligands with Ae[N(SiMe3)2]2(thf)2 (Ae = Mg, Ca, Sr, Ba) via transamination could result in mixed heteroleptic compounds. However, they are not well understood. Attempts to understand the formation of these heteroleptic Ae compounds and further expand upon these efforts using similar ligand systems are explored. Additionally, it was hypothesized that an intermediate heteroleptic species could be trapped, Ae[N(SiMe3)2(L)](thf)2 (L = tBu2pz, NNN-pincer, HFPP). This work is focused on the preparation of heteroleptic species by treating Ae[N(SiMe3)2]2(thf)2 (Ae = Ca, Sr, Ba) with the target ligands. This poster will outline recent experiments and discuss new results. Additionally, sublimation studies will be carried out to test the volatility of these compounds.