

## Polyborane and Carborane Polymers

As a result of our interest in the design of new polymeric precursors to nonoxide ceramics, we have developed new general metal-catalyzed methods for the syntheses of polyborane and carborane polymers.

These polymers, possessing organic backbones and inorganic pendant groups, have unique properties and applications in the materials science and engineering. We have previously shown that the zirconium systems efficiently polymerize alkenyldecaborane to poly(alkenyldecaborane) and our report was the first application of such a catalyst for an alkenylpolyborane polymerization. We later showed that zirconium systems also polymerize alkenyl-*o*-carborane to poly(alkenyl-*o*-carborane) with very high conversion. In terms of the late transition metals, we have successfully demonstrated that ruthenium catalyzed the ring opening metathesis polymerization of cyclic strained decaborane-modified olefins to poly(alkenyldecaborane) polymers with unusually high molecular weights for the inorganic polymers. More recently, we showed that Pd(II)-/Ni(II)- based catalysts polymerize 1-alkenyl-*o*-carborane to poly(1-alkenyl-*o*-carborane) very effectively.

Given the nature of these polymers, we initially had difficulty characterizing their molecular weights. Because these polymers don't have the same random-coil structure as polystyrene, calibration of molecular weights using retention time with a UV-Vis detector fails to give reasonable results (for example,  $M_n$  of our polymer was determined to be 31,000 by light scattering, yet just 9,000 by UV-based column calibration). With the help of Team Wyatt, we set up a light scattering SEC/GPC system.

The light scattering technique employing the Wyatt Technology miniDAWN TriStar detector and the Optilab RI gave promising results. Both the poly(organodecaborane) and poly(organo-*o*-carborane) polymers were fully characterized with molecular weights and polydispersities. Our results demonstrate the successful application of the light scattering technique in the inorganic context.

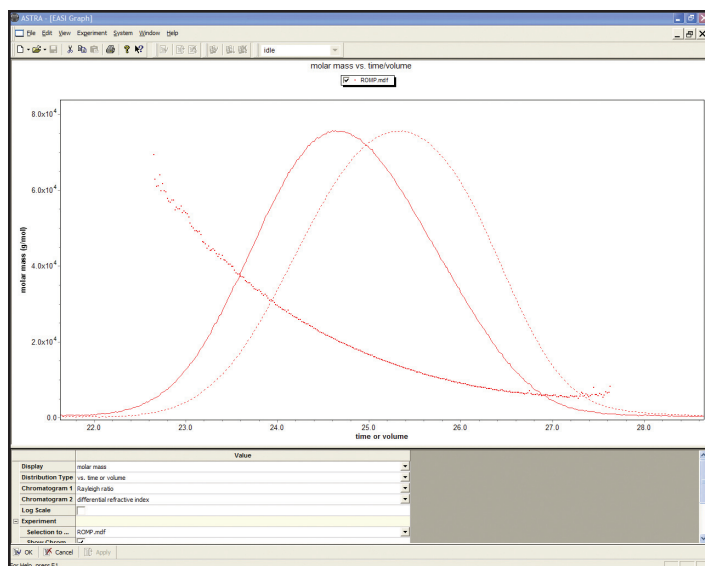


Figure 1. The Molar Mass vs. Volume plot showing the beautiful sample separation and mass calculations

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