The University of Akron
Department of Polymer Science

Formal Seminar
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9:00 A.M., Goodyear Auditorium
Goodyear Polymer Center

Synthesis of Polyisobutylene-Silica Hybrid Stars and Networks via Sol-Gel Processing

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ABSTRACT

Two of the major problems with the use of polymers in engineering applications are their low degrees of stiffness and strength as compared to metals. On the other hand, ceramic materials are ideally suited for use in applications requiring high stiffness and/or strength, but their usage is limited due to their inherent brittleness (low impact strengths). For many years the use of composite materials, formed by the addition of reinforcing fibers or particles to a polymeric resin, have been used as a means for overcoming the limitations associated with these two different classes of materials. However, over the past three decades an innovative strategy for the production of composite materials with new and improved properties has been evolving.[1,2] This novel approach involves the synthesis of hybrid materials, in which inorganic fillers with dimensions on the nanometer size scale are dispersed within and bound to a polymer matrix, resulting in a class of materials known as nanocomposites.[3]

One class of nanocomposite materials that has received much attention is a group of hybrid materials known as CERAMERs (ceramic-polymer).[4] The preparation of these materials relies on the *in situ* generation of ceramic materials via the sol-gel process in the presence of organic polymers bearing functional groups that can form chemical bonds to the resultant ceramic phase.[5] The use of the sol-gel process not only provides a chemically based route for ceramic production, but it also allows for the exertion of control over the composition, size, and morphology of the inorganic phase of the composite material.[6]

Moreover, the combination of quasi-living carbocationic polymerization techniques with the sol-gel process will provide opportunities for the engineering of both inorganic and organic phases of such hybrid materials. In the present study we intend to initially focus on the self-condensation of mono and di-trialkoxysilyl telechelics of polyisobutylene (PIB) for the formation of PIB-silsesquioxane hybrid stars and networks. Future work will focus on increasing the number of trialkoxysilyl substituents per PIB chain and the co-condensation of these materials with tetraalkoxysilane monomers for the production of PIB-silica hybrid stars and networks. The resulting materials may find use in many potential applications ranging from viscosity improvers and paint additives to protective coatings.

References:

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