142ar Polymeric Nano-Porous Materials Prepared Via Interfacial Polymerization in Soft Ionic Liquids

Chien-Yueh Huang, Lining Zhu, Mu-Ping Nieh, Jing Zhang, and Jing Wu

Room temperature ionic liquids (ILs) are molten organic salts with melting temperature normally below 100^{o}C. This class of soft materials containing complicated molecular interactions such as ionic interactions, hydrogen bonding, π-π interactions, and amphiphilic polarization, and rendering various molecular structures from merely local orderness up to macroscopic thermotropic or lyotropic liquid crystalline phases.

Recent reports on spontaneously formed nanostructures of inorganic compounds synthesized in ILs, including ZnO, TiO_2, and silica, showing flower-like crystals or nanowires have received increasing attentions. On the organic counterpart, we have firstly found exotic nano-porous structures in polyurea synthesized by interfacial polymerization between n-hexane (with 2,4-toluene diisocyanate, TDI) and a series of 1-alkyl-3-methylimidazolium tetrafluoroborates and 1-alkyl-3-methylimidazolium hexafluorophosphates (with ethylene diamine or 1,4 diaminobutane). These polymeric materials exhibit volcano-like, coral-like, sphere (~100nm), or polymer fibrils of sizes around 50 nm forming porous structures with pore size ~ 300 nm - depending on the ionic liquids and diamines. Results from small angle x-ray scattering (SAXS, synchrotron source, Brookhaven Laboratories) depict characteristic lengths around 30~40 nm. Micrographs from transmission electron microscopy (TEM) have been used to confirm the structures. We will present the morphological features of the polyurea and discuss the physical origins based molecular interactions: hydrogen bonding, π-π interactions, and molecular orientations due to ionic interactions and polarity that may extend to a quasi long range. Evidences from our recent results in neutron diffraction (ND, Chalk River Laboratories, NRC, Canada) and wide angle x-ray scattering (WAXS) will be incorporated in the discussion to link the scenarios from local molecular scale to the mesoscale of interests. Attempts of understanding the structures and chemicophysical properties of ILs can facilitate their potential applications in chemical industry.