Nanocomposites and nanomaterials

Structure-properties relationships for nanoporous polycyanurates and their nanocomposites

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In the present work, novel nanoporous film materials of thermostable Cyanate Ester Resins (CERs) were generated by polycyclotrimerization of dicyanate ester of bisphenol E *in situ* of the ultra-low amounts of epoxycyclohexyl POSS nanoparticles or/and the varying amounts of different ionic liquids (IL), i.e. 1-heptylpyridinium tetrafluoroborate ([HPyr][BF_4]), 1-methyl-3-octylimidazolium tetrafluoroborate ([OMIm][BF_4]), 2-(hydroxyethylamino) imidazolinium chloride ([HEAIm][HCl]) and polyhexamethylene guanidine toluenesulfonate ([PHMG][TS]), followed by the quantitative extraction of the latter after complete CER network formation. The completion of CER formation and IL extraction was assessed using gel fraction content determination, FTIR, ^{1}H NMR, and energy dispersive X-ray spectroscopy (EDX). The curing kinetics of the polymer network formation was investigated by FTIR analysis. The morphology and porosity features, such as pore diameter and pore size distributions of the samples were estimated by SEM and DSC-thermoporometry. The average pore diameter was found to be around 45-60 nm. The thermal stability of the nanoporous CER-based films was investigated by thermogravimetric analysis (TGA). The gas permeability (He, CO_2) and selectivity (He/CO_2) were measured and the results have been analyzed.