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THERMOSTABLE NANOPOROUS CYANATE ESTER RESINS NEWLY DESIGNED BY USING IONIC LIQUIDS AS POROGENS

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Porous polymeric materials have a large variety of applications in many areas as highly selective membranes, selective adsorbents and filters, porous electrodes for fuel cells, sensors or insulators, etc. High crosslink density Cyanate Ester Resins (CERs) –also known as polycyanurates (PCNs) –are commonly used in aerospace applications and electronic devices as thermostable polymer matrices[1]. Ionic liquids (ILs) are defined as organic/inorganic hybrid salts with melting points below or equal to 100℃. ILs have attracted widespread interest in polymer science, due to their versatile properties, such as negligible saturated vapor pressure, wide liquid-state temperature range, incombustibility, high electrical conductivity, high thermal stability, and stability to oxidation [2-3].

In the present work, novel nanoporous film materials of thermostable CERs were generated by polycyclotrimerization of dicyanate ester of bisphenol E in the presence of varying amounts (from 20 to 40 wt. %) of an ionic liquid (IL), *i.e.* 1-heptylpyridinium tetrafluoroborate([HPyr][BF4]), followed by its quantitative extraction after complete CER network formation. The completion of CER formation and IL extraction were assessed using gel fraction content determination, FTIR, 1H NMR, and energy dispersive X-ray spectroscopy (EDX). The morphology and porosity features, such as pore diameters and pore size distributions of the samples, were estimated by SEM and DSC-based thermoporometry. SEM micrograph demonstrated the formation of nanoporous structures after IL removal from CER networks, thus showing the effective role of IL as a porogen. Pore sizes varied from ~20 to ~180 nm with an average pore diameter of around 45-60 nm depending on the initial IL content. The thermal stability of thenanoporous CER-based films was investigated by thermogravimetric analysis (TGA). The TGA curves showed high thermal stability of the nanoporous films obtained with a decomposition temperature onset near 300°C.

It should be stressed that the synthesis of CERs in the presence of IL was carried out without using any additional solvent or specific catalyst, the ionic liquid being highly thermostable and potentially being utilized repeatedly.

References

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