Hydration Mechanism of Polyimide and Polyamide Aerogels Investigated by NMR Spectroscopy and SANS Techniques

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Aramid aerogels have gained much attention in the last decade due to their excellent mechanical properties in combination with their high porosities, low densities, low thermal conductivities and excellent thermal stabilities. [1] These aerogels are mostly intended to be used in aerospace applications, and the application related properties of these advanced porous materials are directly related to their microstructures. One of the most common conditions that can alter the microstructures of hydrophilic aerogels is the hydration of their backbones. [2] Therefore, the wetting mechanisms of the aramid aerogels were investigated by using nuclear magnetic resonance (NMR) spectroscopy and small angle neutron scattering (SANS) techniques. NMR relaxometry is informative on the extensions of the hydration sphere of the backbone. The geometry and the size of water droplets in the solid backbone can be measured by NMR cryoporometry. The self-diffusion properties of water can be measured by gradient spin echo (PGSE) NMR spectroscopy, and they give information on the permeability of the hydrated pore network. SANS experiments reveal the hydration induced rearrangement of the aerogel backbone and the consequent alteration of the porous structure. The compilation of the data supplied by these diverse techniques makes is possible to understand the hydration mechanism and the hydration induced structural changes of aramid aerogels.

References:

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