A Comparison of Polyurea Aerogel Powders from Three Different Synthetic Procedures

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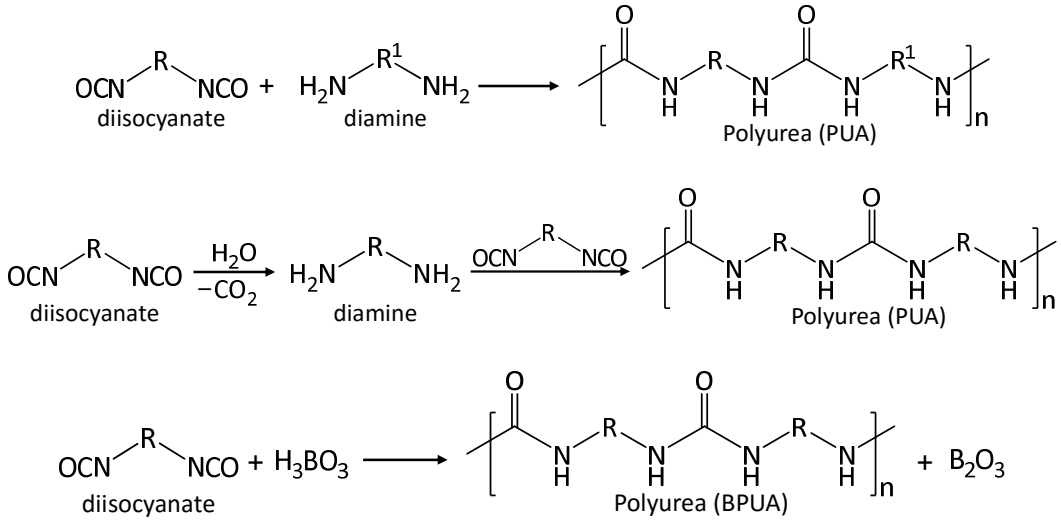
Polyureas (PUA) are a class of polymers that can be defined as the reaction product between multifunctional isocyanates with multifunctional amines (Scheme 1, top). In a more economical approach, the multifunctional amine is formed *in situ* from the reaction of the isocyanate with water (Scheme 1, middle),[1] or PUA can be obtained from a novel reaction of isocyanates with boric acid (Scheme 1, bottom).[2] Both procedures have been applied for the synthesis of PUA aerogels.



Scheme 1. General reaction pathways for the synthesis of polyurea (PUA).

PUA aerogels have good mechanical properties and commercial value for applications in thermal insulation. These properties depend on a combination of factors (e.g., the choice of isocyanates and amines, the solvent, the possibility for hydrogen bonding), which, along with the polymerization conditions, alter the nanomorphology of the polymer.[3]

The synthesis of PUA aerogel powders is more challenging, because in addition to the structural morphology of the network at the nanoscopic level, the particle size and shape are also important attributes of the product. Herein, PUA powders obtained under three different synthetic approaches, (a) disruption of gelation via vigorous agitation, (b) suspension polymerization, and (c) emulsion gelation, in different solvents/solvent systems are being presented. Reaction yields, shape, size and morphology of PUA aerogel powders, as well as their adsorption capability towards a number of gases and humidity are being discussed.

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