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STRATEGIES OF REINFORCEMENT OF SILICA AND POLYMERIC AEROGELS

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Silica and polymeric aerogels share a number of common features, such as extremely low density, pore diameter in the range of 20-100 nm, low thermal conductivity, and poor mechanical properties. Silica aerogels turn into dust with the application of small compressive stress, while polymeric aerogels have poor tensile properties. Consequently appropriate means of reinforcement must be developed to meet broader application needs. This paper evaluates several strategies for reinforcement of aerogels synthesized separately from tetraethoxysilanes and syndiotactic polystyrene. The study shows that in silica aerogels, the secondary particles of pearl-necklace structures provide only limited scope of reinforcement by crosslinking of the surface functionalities with polymers and by hybrid nanoparticles; volumetric reinforcement of the pearl-necklace structures is out of the question. On the other hand, hybrid nanoparticles as well as carbon nanotube are capable of reinforcing the polymeric strands in the aerogel structures. The effects of pH and the quality of solvents on aerogel structures and extent of reinforcement are discussed.