Synthesis of multi-functional porous superhydrophobic trioxybenzene cross-linked silica aerogels with improved textural properties

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ABSTRACT

Silica aerogels are widely interested for their excellent physical and chemical properties. However, silica aerogels are limited in their applications due to their fragile nature. To overcome this, ways of adding organic materials have been investigated. However, due to the large phase separation and particle size differences between organic and inorganic materials, the organic cross-linkers lead to decrease the textural properties, which limits their practical application. Development of organic-modified silica aerogel with ordered porous structure and high surface area has important practical application value. To solve these problems, use of small size organic group i.e. aryl with multiple cross-linking sites not only minimize the phase separation but also provide hydrophobic nature. First, we synthesized three cross-linking agents. Further, trioxybenzene cross-linked ordered silica aerogels were prepared by a simple and economical sol-gel process using these crosslinking agents. 1, 3, 5-trihydroxybenzene shows the best properties (high surface area (1268 m^2/g), low density (0.02431 g/cm^3), low shrinkage, low thermal conductivity (0.061 W/m·K)) and uniform porous nature, due to its molecular symmetric nature. In addition, the cross-linked aerogels are hydrophobic without using silylating reagents. These aerogels are of great interest for applications in thermal insulation as they are prepared via a cost-effective and ecofriendly method.

Keywords: trihydroxybenzene, cross-linking, mesoporous, hydrophobic, thermal insulation

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Reference

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