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Synthesis and characterization of micrometer-sized silica aerogel nanoporous beads

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Synthesis and characterization of micrometer-sized silica aerogel nanoporous beads

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Abstract

Here we report the preparation of micrometer-sized highly nanoporous, relatively trasperant silica aerogel beads with high surface area as well as large pore volume with sizes ranging from 165 to 395 μm. The wet micrometer-sized silica hydrogel beads were prepared through hydrolysis and polycondensation of sodium silicate as a silica precursor. A hydrophobic micro-silica aerogel nanoporous bead was synthesized by simultaneous solvent exchange surface modification process of as synthesized micron sized silica hydrogel bead at an ambient pressure. Hydrophilic micron-sized silica aerogel beads with relatively more textural properties (surface area, pore volume and pore size) with its counterpart were obtained by heating the synthesized hydrophobic micro-silica aerogel beads at 395 °C for an hour. This study demonstrates a robust approach to high porous hydrophobic and hydrophilic micro-silica aerogel beads with a myriad of potential applications in various fileds such as catalysis, biomolecule immobilization, chromatographic separation, and CO2 absorption. This proposed synthesis, which exploits a low-cost silica source (water-glass), is suitable for large-scale industrial production of highly porous hydrophobic and hydrophilic micro-silica aerogel beads at an ambient pressure.

Keywords

Micro-silica aerogel bead; Ambient pressure drying; Nanoporous; Water-glass