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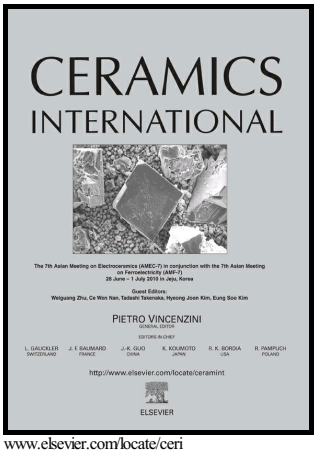

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Preparation of monolithic silica-based aerogels with high thermal stability by ambient pressure drying

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Abstract

A monolithic silica-based aerogels were successfully synthesized via a sol-gel process using tetraethoxysilane and inexpensive inorganic aluminium salt $Al(H_2O)_9(NO_3)_3$ as precursors. The gels were dried at ambient pressure and the molar ratio of Al/Si was varied from 0 to 0.1. The structure and morphology of the aerogels were investigated by field-emission scanning electron microscopy, high-resolution transmission electron microscopy, Fourier transform infrared spectrometry, and N_2 adsorption-desorption. The microstructural images showed that a three-dimensional nanoscale structure formed in the as-prepared aerogels. The specific surface areas of the samples were in the range of 769-821 m^2/g. Furthermore, when the Al/Si mole ratio was 0.1, its specific surface area and total pore volume remained at 103.5 m^2/g and 0.25 cm^3/g respectively after heating at 1100 ^oC for 2 hours, exhibiting the best thermal stability of all aerogels fabricated in this study. The addition of the aluminium salt not only slowed the sintering of the silica, but also crystallization was restrained.