

Zircon oxide aerogels prepared by the epoxy-route and supercritical drying

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Abstract

Zirconium oxide aerogels were prepared using alkoxide precursors and hydrolysis in suitable alcohol/water solutions with various catalysts like acetic or nitric acid and zirconium salts using epoxies like acetylacetone and propylene oxide in water. The gelation process was controlled by varying the sol-composition (alcohol, water, temperature and chelating agents) or simply the amount of epoxy added.

The gelation times could be varied from 1 minute to several days. The wet gel bodies were aged in ethanol. If the precipitation of Zirconium oxide could be suppressed translucent aerogels could be produced after supercritical drying with carbon dioxide. The aerogels prepared had densities in the range from 0.2 to 0.75 g/cm³ with porosities of around 90% and specific surface areas between 250 and 480 m²/g.

The samples were also looked at in scanning electron microscope to reveal the processing effect on the 3D nanostructure. A few samples were heat treated at 700°C, 1000°C and 1250°C and the resulting structure analyzed with XRD to observe the time dependent increase of crystalline structures inside the originally amorphous aerogels. The paper describes the production routes, the properties achieved as a function of the process parameters (catalyst concentration, chelating agent, aging time and medium) and compares alkoxide precursor routes with the epoxy method.