12. Abhijit Pisal - Synthesis of low density and high temperature resistant Y_2O_3 doped silica aerogels

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Abstract

Commercialization of aerogels has been slow down due to high cost and manufacturability issues [1]. Therefore, in the present paper, we manufactured silica aerogels at low cost and low risk. In this paper, we report the experimental results on the synthesis of low density and high temperature resistant Y2O3 doped silica aerogels. Silica sols were prepared by keeping the molar ratio of TEOS: ethanol (EtOH): water (0.01 M HCl as acid catalyst): Ammonium Flu-oride (0.5 M NH4F as base catalyst) was kept constant at 1:15:7:0.6 respectively, while the weight percent of Y2O3 powder was varied from 0.1 to 4%. The aerogels have been produced by two-stage sol-gel process followed by supercritical CO2 drying. The best quality silica aer-ogel in terms of low high-temperature thermal conductivity (0.097 W.mK-1 at 1000 ^{0}C), low density (26 mg/cc) and high optical transmission (about 87% in the red region) have been obtained with molar ratio of 1TEOS: 15EtOH:7water:0.6 NH4F and 3% of Y2O3 powder. The best quality Y2O3 doped silica aerogel is as shown in figure (Fig 1).

Fig 1. Y_2O_3 doped silica aerogel

The Y_2O_3 doped aerogels have been characterized by SEM (Scanning Electron Microscopy), FTIR (Fourier Transform Infra-Red Spectroscopy), Optical transmittance, TG/DTA (Thermogra-vimetry/Differential Thermal Analysis, Thermal conductivity and BET (Brunauer-Emmett-Teller) analysis. The experimental results on the physical and thermal properties of Y2O3 doped silica aerogels under normal and high temperature have been discussed by taking into account the chemistry and porosity of aerogels.

References

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