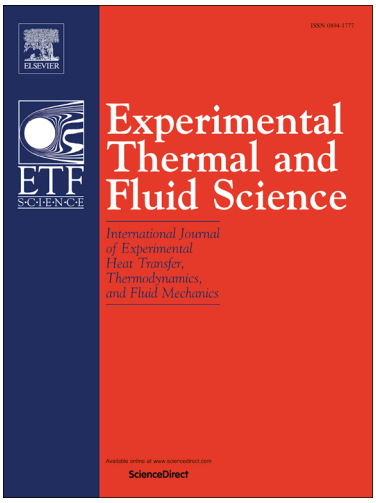

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Measuring radiative properties of silica aerogel composite from FTIR transmittance test using KBr as diluents

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Abstract

Radiative properties such as spectral extinction coefficient, Rosseland mean extinction coefficient and radiative thermal conductivity are the key features of porous insulation materials. For silica aerogel composites with fiber and opacifier, it is difficult to determine the spectral extinction coefficient and radiative thermal conductivity via experiment accurately. The spectral extinction coefficient of such composites is usually determined by a transmittance test using KBr as a diluent. The traditional model has several assumptions on determining the extinction coefficient from the transmittance measurement: the diluents are assumed as a pure transparent medium, the pressed pellet has no reflection, and the composite powder is in series with the KBr when calculating the effective thickness of the composite. Thus, the extinction coefficient determined from the traditional model with these assumptions will result in some uncertainty on predicting the radiative thermal conductivity. To overcome the drawbacks, improved models are proposed by considering the absorption of KBr diluents, sample reflection and random distribution of sample powder in the diluents. KBr diluted silica aerogel composite pellets with the same constituents and concentrations but different thicknesses are prepared using the pressed pellets method. The transmittances of the pressed pellets are measured by Fourier transform infrared spectroscopy (FTIR). The spectral extinction coefficients are calculated from the measured transmittances with proposed models. The radiative thermal conductivity of silica aerogel composite is calculated with the measured Rosseland mean extinction coefficient determined from different models. This study found that the developed models could eliminate the assumptions of the traditional model.

Keywords: extinction coefficient; radiative thermal conductivity; silica aerogel