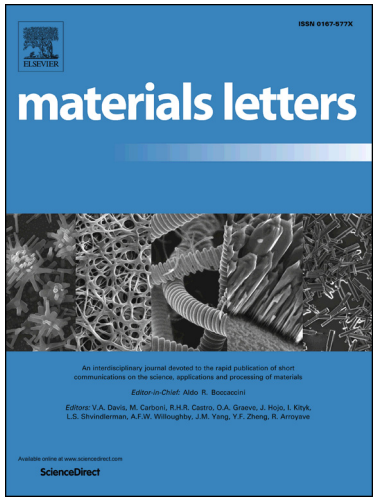

Spray freeze-dried monolithic silica aerogel based on water-glass with thermal superinsulating properties

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Spray freeze-dried monolithic silica aerogel based on water-glass with thermal superinsulating properties

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Abstract

In this study, silica aerogels were prepared using water-glass precursor based on two drying strategies, namely conventional freeze drying (C-FD) and spray freeze drying (S-FD). It was known that the pore structure of silica aerogel can be optimized uniformly based on S-FD method when tert-butyl alcohol is directly utilized as a solvent. As a result, silica aerogels obtained by the S-FD method are monolithic with high thermal stability and low thermal conductivity, showing a great potential of thermal insulation materials for high-temperature environment.

Keywords

Silica aerogels; Spray; Freeze drying; Thermal insulation; Thermal stability

1. Introduction

Silica aerogel is a porous material with a low density (3 kg/m^3), high porosity (95.3%) and large surface area (> 800 m^2/g) [1]. Besides, crisscrossed mesopores enable an extremely low thermal conductivity. Based on that, silica aerogels are widely applied in thermal insulation fields [2]. However, the commercial applications of silica aerogels show a series of difficulties in the practice, such as high costs [3].

For now, the production of silica aerogels typically relies on supercritical drying technology, which is a very costly process under employing high pressure and

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