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Facile fabrication of functional silica aerogel with gradient transmittance and refractive indices via slope-rotation method

Xiao Pang^a, Xuan Luo^a, Jiayi Zhu^b, Lin Zhang^{a,b*}

^a Science and Technology on Plasma Physics Laboratory, Research Center of Laser Fusion, China Academy of Engineering Physics, P.O.Box 919-987, Mianyang, 621900, P. R. China.

^b Joint Laboratory for Extreme Conditions Matter Properties, Southwest University of Science and Technology and Research Center of Laser Fusion, Mianyang, 621000, P. R. China

*Corresponding author. E-mail: zhlmy@sina.com

Abstract

Functionally gradient silica aerogels have been applied in many areas with their gradient porosity, refractive indices and acoustical impedance. For the purpose of accurately controlling the process of gradient formation, a new approach called slope-rotation method was proposed. Such a method could benignly fabricate gradient density sol by sloping, rotating and mixing the two different density sols in one-step. Gradient density aerogel was obtained after ethanol supercritical drying. The microstructure and density distribution of aerogels were characterized by nitrogen adsorption, scanning electron microscopy, and X-ray phase contrast. The transmittance and refractive index were tested by UV-visible absorption spectrum and a self-built device. The results indicated that the transmittance and refractive index had been gradient changed with the gradient density. This approach was an effective method for the preparation of gradient density silica aerogels and could be suitable for producing gradient density porous materials derived from a sol-gel process.

Keywords

Sol-gel preparation, gradient density, porous materials, refractive index, slope-rotation

Introduction

Aerogels are widely applied in lots of areas due to their unique physical properties. [1-3] Ever since silica aerogels with density gradient were successfully applied in Stardust, [4] lots of attentions had been paid to gradient density porous materials. Because most of intensive physical properties correlated to the density, they would be gradient in their properties as well. Control of the density distribution then carried over into the localized control of other physical properties within a sol-gel porous material. As a result of such an idea of material design, materials have been fabricated that incorporated regions of tailored density and thus gradient porosity, [5] acoustical

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