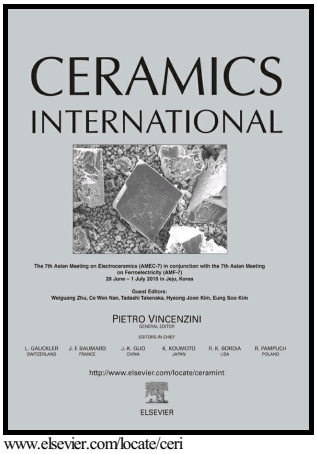

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Elnaz Irom, Mohammad Zakeri, Ali Sedaghat Ahangari Hossein Zadeh

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Effect of annealing process on IR transmission and mechanical properties of spark plasma sintered Yttria

Elnaz Irom, Mohammad Zakeri*, Ali Sedaghat Ahangari Hossein Zadeh

Ceramic Department, Materials and Energy Research Center (MERC), P.O. Box 14155-4777, Tehran, Iran

Abstract

In this study, fully dense Yttria ceramics were successfully fabricated by spark plasma sintering (SPS) at temperatures of 1300 and 1350 ℃. The effects of post-annealing on IR transmission were investigated by Fourier transform infrared spectroscopy (FTIR) at various temperatures ranging from 1050 to 1250 ℃. It was found that the optimum annealing temperature depends strongly on the sintering temperature. Annealed samples showed white opaqueness mainly due to the increase and coalescence of pores after annealing and showed an absorption band around 6.6 μm which limits usage of yttria in IR applications. Sintering at 1350 ℃ and annealing at 1250℃ led to the maximum IR transmittance above 80% at wavelength of 5μm for a 3.5-mm-thick sample. The hardness and the fracture toughness of the samples were analyzed in detail and hardness of 9.2 GPa and fracture toughness of 1.65 MPa.m$^{1/2}$ were obtained for the above sample.

Keywords: Annealing, Sintering, ceramics, Mechanical properties, IR transmission

1. Introduction

Optical ceramics have played a crucial role in both civil and military industries in the wide range of applications such as windows and domes, solid state laser gain media,

* Corresponding author: Mohammad Zakeri m_zakeri@merc.ac.ir
Tel: +98(26)36204131 Fax: +98(26)36201888