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Effects of Deformation Rate on Properties of Nd,Y-codoped CaF₂ transparent ceramics

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Abstract

Different deformation rates of Nd,Y-codoped CaF₂ transparent ceramics were prepared by ceramization of single crystals. The deformation rate effects on the crystallization behaviors, microstructures, mechanical properties, and optical performances were investigated for the first time. The results indicate that the comprehensive performances of Nd,Y-codoped CaF₂ ceramic ($\Delta a = 62\%$) are the most optimal compared with other ceramics having different deformation rates ($\Delta a = 34\%, 40\%, 50\%$, and 75%). In further investigations of the optical properties, the Nd,Y-codoped CaF₂ ceramic ($\Delta a = 62\%$) sample exhibited a high transparency ($T_a > 91\%$, 3-mm thick, 250~1200 nm), low light scattering, superior fracture toughness ($K_{1c} \sim 0.71 \text{ MPa}\cdot\text{m}^{1/2}$), strong fluorescence emission, long lifetime ($\tau = 348.72 \text{ }\mu\text{s}$), and broad FWHM (29.2nm), promising a good candidate for high-power laser material.

Keywords: Ceramization of single crystals; Transparent Ceramics; Nd,Y-codoped CaF₂

1. Introduction

Calcium fluoride (CaF₂) crystal shows a high thermal conductivity ($9.7 \text{ W}\cdot\text{m}^{-1}\cdot\text{K}^{-1}$), high transmittance, and good solubility of both the sensitizer and

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