

Nd, Y:CaF₂ 及び Nd, La:CaF₂ セラミックスのレーザー発振特性評価Laser performances of Nd,Y:CaF₂ and Nd,La:CaF₂ ceramics

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CaF₂ is a promising host material especially for Ln³⁺-activated ultrafast lasers. Despite the fact that Nd³⁺-activated CaF₂ single-crystal lasers and CaF₂ ceramic lasers activated by other Ln³⁺ ions have been well studied, laser operation of Nd³⁺-activated CaF₂ ceramics has not been reported to date. Synthesizing a ceramic material with a proper composition and enough good optical quality is critical to this subject.

Recently we demonstrated Nd³⁺-activated CaF₂ ceramic lasers for the first time, using two ceramic gain materials, 1%Nd,1.8%Y:CaF₂ and 1%Nd,2%La:CaF₂. They were fabricated by reactive sintering and hot isostatic pressing method. Optical microscopic analysis indicated no noticeable residual pores on the surface and good optical isotropy inside the materials. The transmittance at 1064 nm of Nd,Y:CaF₂ and Nd,La:CaF₂ were measured to be 90% and 91%, respectively. These values are superior to the reported values of a 2-mm-thick 5% Nd:CaF₂ ceramic (~88%) and a 2-mm-thick 1% Nd, 1%La:CaF₂ ceramic (~88%). The fluorescence lifetimes of these two ceramics were measured to be around 220 μ s, which are comparable to that of a 1%Nd, 2%Y:CaF₂ single crystal (208 μ s). Preliminary laser experiments were carried out under quasi-cw pumping at ca. 791 nm. The slope efficiencies were found to be 1.0% and 1.9% for the Nd,Y:CaF₂ and Nd,La:CaF₂ ceramic lasers, respectively. The lasing wavelengths were measured to be 1064 nm for Nd,Y:CaF₂ and 1065 nm for Nd,La:CaF₂, which correspond to the peak wavelengths of the emission cross-section spectra. Works on enhancing the efficiency of these ceramic lasers are in progress. The detailed synthesis methodology, spectroscopic properties, and laser performances will be reported in the conference.

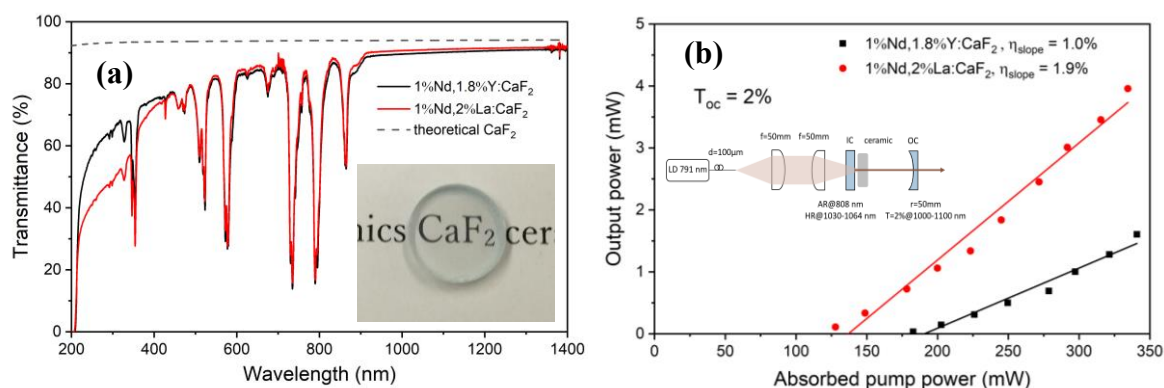


Figure 1. (a) Transmission spectra and photograph of the Nd,Y:CaF₂ and Nd,La:CaF₂ ceramics; (b) Laser cavity setup and output characteristics of the Nd,Y:CaF₂ and Nd,La:CaF₂ ceramics.