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Pump-probe experiments with Ce³⁺+Yb³⁺:KY 3F10 and Ce³⁺+Yb³⁺:CaF₂ crystals

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Abstract

Here we report on pump-probe studies of KY₃F₁₀ and CaF₂ doped with Ce³⁺ and Yb³⁺ ions. The crystals Ce³⁺:KY₃F₁₀ and Ce³⁺:CaF₂ show attractive spectral characteristics for tunable UV lasers application but have poor photochemical stability. Their properties under intense UV pumping are affected by excited state absorption and color centers formation. This work was aimed at dynamic processes investigation induced by laser radiation of UV spectral range in KY₃F₁₀ and CaF₂ doped with Ce³⁺ and Yb³⁺ ions. Optical gain was observed on CaF₂:Ce³⁺+Yb³⁺ in the range 325-335 nm for the first time. It proves Yb³⁺ ions coactivation antisolarant effect elaborated by us earlier³. It is shown that in investigated crystals under a pump radiation, resonant to 4f-5d Ce³⁺ ions transitions several types of color centers (CC) are formed. Set of these CC types are determine the absorption at expected stimulated emission spectral range and magnitude of the induced losses is dependent on many factors. As a result of competition between CC formation, free charges recombination and CC photodestruction this balance can be shifted towards either rising or dropping losses at 5d-4f Ce³⁺ ions luminescence spectral range. © 2011 SPIE.

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Keywords

5d-4f transitions of Ce³⁺ ions, Optical gain, Photoinduced color centers