

## LASER-INDUCED CRYSTALLIZATION OF NANOCRYSTALLINE RARE-EARTH DOPED YTTRIUM TITANATES (REXY<sub>1-X</sub>)<sub>2</sub>Ti<sub>2</sub>O<sub>7</sub> THIN FILMS

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### Abstract

Nanocrystalline rare-earth doped yttrium titanates, which crystallize in a pyrochlore structure with general formula RE<sub>2</sub>Ti<sub>2</sub>O<sub>7</sub> or (RE<sub>x</sub>Y<sub>1-x</sub>)<sub>2</sub>Ti<sub>2</sub>O<sub>7</sub> (RE=rare-earth element), have been investigated for their interesting luminescence and magnetic properties. However, their physico-chemical properties limit the preparation of microstructures and integrated structures.

In this contribution we present the laser-assisted preparation of nanocrystalline Eu<sub>2</sub>Ti<sub>2</sub>O<sub>7</sub> and (Eu<sub>0,5</sub>Y<sub>0,5</sub>)<sub>2</sub>Ti<sub>2</sub>O<sub>7</sub> thin films and the laser processing of microstructures inside the films.

Highly transparent amorphous thin films of the thickness about 500 nm were prepared by the sol-gel method. Prepared films were irradiated by CO<sub>2</sub> laser or thermally treated up to 1200 °C to prepare nanocrystalline material. Alternatively, the oriented microstructures such as ribbons and pillars were written by the laser beam into the thin films. Formation of nanocrystals was observed by the structural methods and by the steady-state luminescence measurement.

The presented approaches led to the formation of homogenous nanocrystalline Eu<sub>2</sub>Ti<sub>2</sub>O<sub>7</sub> and (Eu<sub>0,5</sub>Y<sub>0,5</sub>)<sub>2</sub>Ti<sub>2</sub>O<sub>7</sub> thin films with tailored grain sizes ranging from 20 nm to 120 nm. It was found that the laser beam induced the nucleation process, however it didn't significantly contribute to the crystal growth and to the recrystallization of formed nanocrystals. Selective laser writing allowed to prepare oriented microstructures such as ribbons and pillars.

The results bring information about the laser processing of nanocrystalline rare-earth titanates thin films. The promising applications of prepared nanocrystals and prepared microstructures in the field of planar optical amplifiers are widely discussed.

**Keywords:** Nanocrystals, laser, rare-earth, luminescence

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