

Spectroscopic signature of pyrochlore erbium titanate nanocrystals precipitated in high phonon silicate matrix



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Biography

H C Vasconcelos graduated in Physical and Materials Engineering and got a Materials Engineer Doctor's degree (Ph.D.) from the Instituto Superior Técnico, Lisboa, Portugal. Presently, she is a professor at the Azores University, Ponta Delgada, where she lectures on a wide range of subjects at both under and postgraduate level, including Physics, Biophysics, Physics Applied to Biologic Sciences and Biomaterials. She is a member of the Portuguese Physics Society and of the Portuguese committee of the program hands on particle physics master classes - CERN. She chaired several International conferences and develops her research activity within the CEFITEC (Centre for Physics and Technological Research) at Universidade Nova de Lisboa, Portugal.

Abstract

Several rare-earth doped optical materials have been developed for photonic applications, mainly for applications such as semiconductor lasers (or diodes), fluorescent labels and optical amplifiers. In particular, erbium ions (Er^{3+}) doped SiO_2 sol-gel glasses have attracted increasing importance as amplifier devices. The incorporation of TiO_2 into the SiO_2 glass, as a structural modifier, is a suitable strategy to reduce the high phonon energy of asymmetrical Si-O-Si stretching vibrations ($\sim 1080\text{--}1100\text{ cm}^{-1}$) in the SiO_2 glass, while that of the Si-O-Ti bonds is comparatively lower ($\sim 920\text{--}960\text{ cm}^{-1}$). TiO_2 co-doping creates (Si-OTi) bonds in the glass structure, as demonstrated by the FTIR spectrum. On the other hand, during the annealing process, ETO Nano crystallites can be single precipitated in the main matrix for specific conditions (depending on Er^{3+} content, temperature and time of heat treatment) as revealed by XRD. Er^{3+} ions are thus divided between the host glass and the nano crystallites. This ordered (crystalline) environment would avoid undesired Er^{3+} ions clustering. In a previous work, it was revealed that Er^{3+} ions within $\text{SiO}_2\text{-TiO}_2$ sol-gel glasses are inserted in nanocrystals of pyrochlore erbium titanate, $\text{Er}_2\text{Ti}_2\text{O}_7$ (ETO). Additionally, a pure $\text{Er}_2\text{Ti}_2\text{O}_7$ pyrochlore based waveguide was obtained with remarkable spectroscopic properties and reduced non-radiative absorption mechanisms. However, no signature of such phase considering its spectroscopic characteristics in host glasses was reported yet. In this work, an optical spectroscopic analysis of ETO in transparent $\text{SiO}_2\text{-TiO}_2$ glass-ceramics is presented.

Publications

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