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CO_2 laser annealing on Er^{3+}/Yb^{3+}-activated SiO_2-SiC nanocomposites for photonics

C. Goyes[(1,2)*], P.C. Morales[(1)], A. Chiasera[(2)], F. Fonthal[(3)], G. C. Riguini[(4,5)], M. de los Rios[(6)] and M. Ferrari[(2)]

(1) Grupo de Automática y Robótica GAR, Pontificia Universidad Javeriana,Cali, Calle 18 No. 118-250 Av. Cañasgordas, Cali, Colombia, e-mail: cgoyes@javerianacali.edu.co
(2) CNR-IFN, Istituto di Fotonica e Nanotecnologie, CSMFO group, via Sommarive 14, 38050 Povo, Trento, Italy
(3) Grupo de Investigación en Materiales Avanzados para Micro y Nanotecnología, Universidad Autónoma de Occidente, Campus Valle del Lili Km 2 Vía Jamundí, Cali, Colombia
(4) CNR, Department of Materials and Devices, via dei Taurini 19, 00185 Roma, Italy
(5) CNR-IFAC, N. Carrara Inst. Appl. Physics, via Madonna del Piano 10, 50019 Sesto Florentino, Firenze, Italy
(6) Laboratorio de Optoelectrónica, Universidad del Quindío, Carrera 15, Calle 12N Armenia, Colombia
* Corresponding author.

Abstract – Er^{3+}/Yb^{3+}-codoped SiO_2-SiC nanocomposites were fabricated by rf-sputtering technique. The active films were deposited on silicon and silica glass substrates. The thickness of nanocomposites and the refractive index at 514 nm, 632.8 nm, 1319 nm and 1542 nm were measured by an m-line apparatus. In this work we present an alternative method combining rf-sputtering and CO_2 laser annealing (wavelength, λ = 10.6 μm) for nanocomposites processing.

In order to produce active rare earth nanocrystals in a glass matrix, heat treatment using a furnace has been commonly used, but a potential candidate for reaching future technology nodes is the laser annealing (LA) process [1-2]. In this work we present an alternative method combining rf-sputtering and CO_2 laser annealing (wavelength, λ = 10.6 μm) for nanocomposites processing. Er^{3+}/Yb^{3+}-codoped SiO_2-SiC nanocomposites were fabricated by rf-sputtering technique. The samples were investigated by photoluminescence spectroscopy and the thermal conventional annealing effects for these systems are reported for comparison; high resolution transmission electron microscopy has shown that after an adapted heat treatment the resulting materials show nanocrystalline structures. The emission at 1530 nm of the $^4I_{13/2} \rightarrow {}^4I_{15/2}$ transition of Er^{3+} ion was observed at room temperature for all the samples upon continuous-wave excitation at 980 and 488 nm.

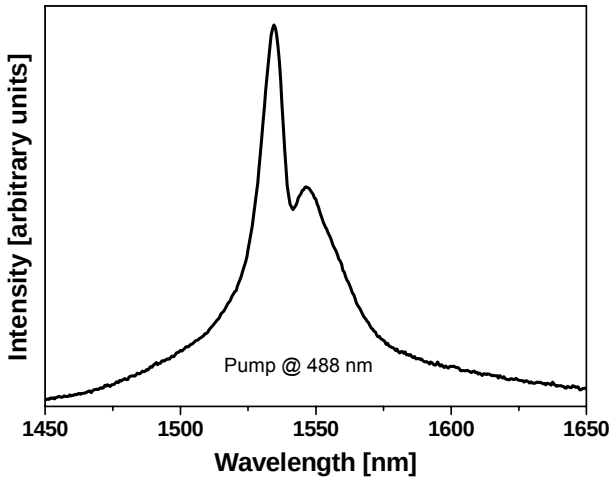

Figure 1. Photoluminescence spectra relative to $^4I_{13/2} \rightarrow {}^4I_{15/2}$ transition of the Er^{3+} ions for Er^{3+}/Yb^{3+}-codoped SiO_2-SiC nanocomposites after CO_2 laser annealing at 10 min of irradiation time. The emission spectra were obtained using an argon laser operating at 488 nm as a pump beam..

[1] C. Goyes, C. Armellini, M. Ferrari, A. Chiasera, Y. Jestin, G.C. Righini, E. Solarte, A. Casas, A. Devia, C. Meacock. Photonics West 2007 – Proc. of SPIE Vol. 6458 64580D-1, San Jose, USA (2007).

[2] C. Goyes, M. Ferrari, C. Armellini, A. Chiasera, Y. Jestin, G.C. Righini, F. Fonthal, E. Solarte. Optical Materials, In Press, Corrected Proof, Available online 26 April 2009