

# Rare Earth based composites with Potential Random Laser Application

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The present study investigates the random lasing properties of glass capillaries systems using rare earth doped nanoparticles. Random lasers are optical structures in which light waves are both multiply scattered and amplified. To validate the system the laser dye Rhodamine B was used. The composite was prepared by dispersing the dye into aluminoxane-epoxi-siloxane hybrids together with powder Boehmite and filling fused silica capillaries (Figure 1a). The dye would act as the gain medium whereas the Boehmite particles act as the scattering medium. A second set of samples were obtained by filling the silica capillaries with  $\text{YVO}_4\text{:Eu}^{3+}$  nanoparticles dispersed into the same hybrid material. In this case the rare earth doped nanoparticles act as both gain and scattering medium. Simple aqueous colloidal synthesis are used for the preparation of concentrated  $\text{YVO}_4\text{:Eu}^{3+}$  colloids<sup>1</sup>; Boehmite-GPTS (GPTS-glycidoxypopyltrimethoxysilane) hybrids have been prepared by the sol-gel methodology<sup>2</sup>, Boehmite powder was synthesized by spray-pyrolysis and the glass capillary was produced by the photonic lab at UNESP (Brazil). Random laser emission tests were performed in the Rhodamine B composite using a Nd:YAG laser to pump the system and a typical laser threshold behaviour was observed for a pumping power of approximately 0,35mW (inset of Figure 1b). The random laser emission spectrum shows the tuneable behaviour of the composite as a result of the combination of the broad emission spectrum of the dye and the different sized Boehmite particles (Figure 1b). The luminescence measurements of the  $\text{YVO}_4\text{:Eu}^{3+}$  composite were carried out, and high intensity emission from the europium ion was detected (Figure 1c). Further analyses are being performed to observe random laser threshold behaviour.

## References

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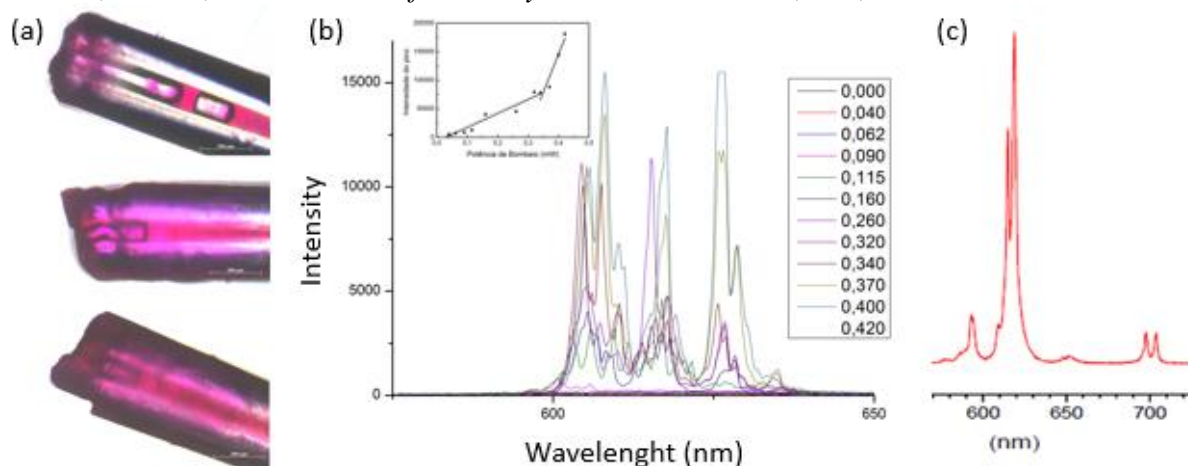


Figure 1 – (a) Photograph of the Rhodamine B filled capillaries, (b) laser threshold behavior observed for the Rhodamine B composite, and (c) emission spectrum of  $\text{YVO}_4\text{:Eu}^{3+}$  composite ( $\lambda_{\text{ex}} = 275\text{nm}$ ).