PVDF/Eu_2O_3/Buriti Oil Luminescent Composite Films as Potential Temperature Sensors

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Over the past few years photoluminescent sensors based of rare earth in polymer matrices have received great attention. In this context, Eu^{3+} is widely used as activator ion in red phosphors as well as an agent in the production of fluorescent glasses [1]. On the other hand, the Polyvinylidenefluoride (PVDF) is a semicrystalline polymer extensively studied because of its wide range of applications [2] and it can act as a polymer matrix due to the fact that it exhibits easy processing, excellent mechanical property, thermal stability and high chemical resistance. It is increasingly common the use of vegetable oils in the developments and modifications of polymeric materials to increase properties like porosity and flexibility. The Buriti oil (BO) *Mauritia flexuosa* is an interesting polymer modifier with a composition rich in oleic acid and carotenoid pigments, showing a large absorption in ultraviolet and visible and emission in the visible region [3]. In this way, the aim of this work was to synthesize the PVDF/Eu_2O_3/BO composite and to evaluate the effect of a cryogenic treatment by using liquid N_2 on the luminescent properties of the composite. The composite was prepared by the method of "casting" using dimethylformamide as solvent mixed with PVDF, Eu_2O_3 and BO. The films were dried in an oven at 55 °C for 20 h. Samples were immersed in liquid N_2 at - 160 ° C for 1 minute, Fig. 1(a). Fixing 267 nm excitation, that fits $O^{2-} \rightarrow Eu^{3+}$ charge transfer band, Fig.1(b), the emission spectra show the expected $^5D_0 \rightarrow {}^7F_{0\text{-}4}$ Eu(III) set of transitions which spectral profile is characteristic for europium oxide cubic structure, and a large band centered at 410 nm assigned to the buriti oil. The cryogenic treatment of the composite causes an emission quenching of the BO fluorescence and an increase in the Eu(III) relative emission intensity. Furthermore, due to the fact that spectral profile is unchanged after cooling treatment, and only the relative intensities between the emitter species are affected, the local structure of Eu^{3+} is preserved. Therefore, the cryogenic treatment by N_2 enhances the relative emission intensity of Eu^{3+} quenching the Buriti oil emission, indicating that this can be considered a promising system to be evaluated as potential temperature sensor.

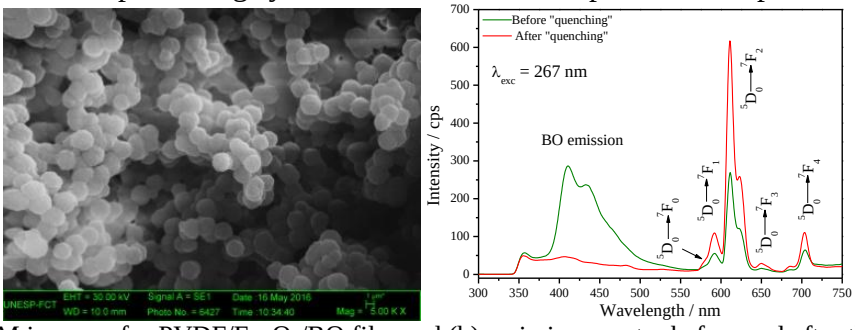

Fig 1. (a) SEM imagem for PVDF/Eu_2O_3/BO film and (b) emission spectra before and after the cryogenic treatment by liquid N_2 in PVDF/Eu_2O_3/BO film.

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