$Sr_2MgSi_2O_7:Eu^{2+}$, Dy^{3+} long persistent luminescence material synthesized by microwave-assisted solid-state method (MASS)

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Persistent luminescence materials can emit light for several hours after ceasing an irradiation source. Studies involving these materials have increased in lasts years mainly due to their singular properties [1]. Dissilicates ($Sr_2MgSi_2O_7$) present promising results, however the ordinary processes require high annealing temperatures and time (~1200 °C, 5 h). A current challenge is find alternatives synthesis methods that can reduce these elevated time and temperatures required. *Microwave-Assisted Solid-State* synthesis (MASS) is an excellent alternative that can achieve high temperatures in only a few minutes allowing synthesis times around 25 minutes. In this work, $Sr_2MgSi_2O_7:Eu^{2+},Dy^{3+}$ was synthesized by MASS. The $SrCO_3$, $(MgCO_3)_4(Mg(OH)_2)$, SiO_2, and R_2O_3, (R^{3+}: Eu, Dy) precursors were grinded and then annealed in a domestic microwave oven using carbon as susceptor at 1000 W for 10 minutes and 900 W for 15 minutes. The excitation spectrum (Fig.1 left red) shows a broad band from 250 to 450 nm assigned to the Eu^{2+} $4f^65d^1 \leftarrow 4f^7$ transitions. Several Eu^{3+} 4f – 4f absorption peaks are observed at *e.g.* 396, 420 and 450 nm. The emission spectra (Fig. 1, left blue) shows a broad band centered at 470 nm arising from Eu^{2+} parity allowed $4f^65d^1 \rightarrow 4f^7$ transition with no Eu^{3+} emission, which indicates energy transfer from Eu^{3+} to Eu^{2+}. The CIE chromaticity diagram (Fig. 1 right) shows a blue color (x: 0.105; y: 0.236). An important characteristic of this material is the possibility to excite efficiently in the visible range (blue region), allowing applications in the storage of sun light energy.

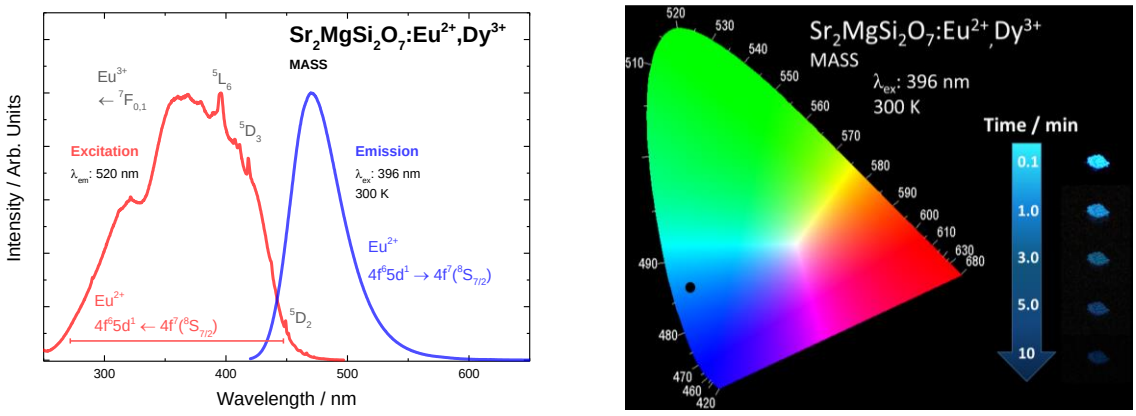

Fig. 1 – Excitation (left, red), emission (left, blue) spectra, CIE coordinates diagram and photos of persistent luminescence after ceasing 365 nm irradiation (right) of $Sr_2MgSi_2O_7:Eu^{2+},Dy^{3+}$ material prepared by MASS.

Keywords: Blue emission photonic material, Light storage, Divalent europium (Eu^{2+}), Persistent luminescence, Microwave-assisted solid-state synthesis (MASS).

Acknowledgements

This work was supported by CNPq and CAPES.

References

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