Rapid and energy-saving microwave-assisted solid-state synthesis for persistent luminescence materials preparation

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Persistent luminescence is a phenomenon where the material emits radiation from seconds to several hours after cessation of irradiation. Currently it is known that persistent luminescence results from storage of the excitation energy in traps and its subsequent release induced by thermal energy available at the appropriate temperature [1]. Persistent luminescence materials are commonly obtained by ceramic method, which consists in sintering the precursors at very high temperature in controlled atmosphere. This method usually yields large particles with very low surface area. Besides, the long reaction time needed increases the costs of production. Some possible alternatives to the ceramic method on the materials processing are sol-gel, Pechini, combustion and microwave-assisted solid-state synthesis (MASS). This last presents advantages like the short processing time, selective dielectric heating, low energy consumption, and use of inexpensive equipment (domestic microwave oven), often affording high purity and high-yield products [2]. In this work, persistent luminescence materials $Lu_2O_3:Tb^{3+},Ca^{2+}$ and $Ca_2SnO_4:Sm^{3+}$ were thus prepared by the MASS method (Figure left). The materials' properties, such as phase purity, crystallinity, particle morphology and persistent luminescence (Figure right), were investigated and compared to those of materials prepared by a ceramic method.

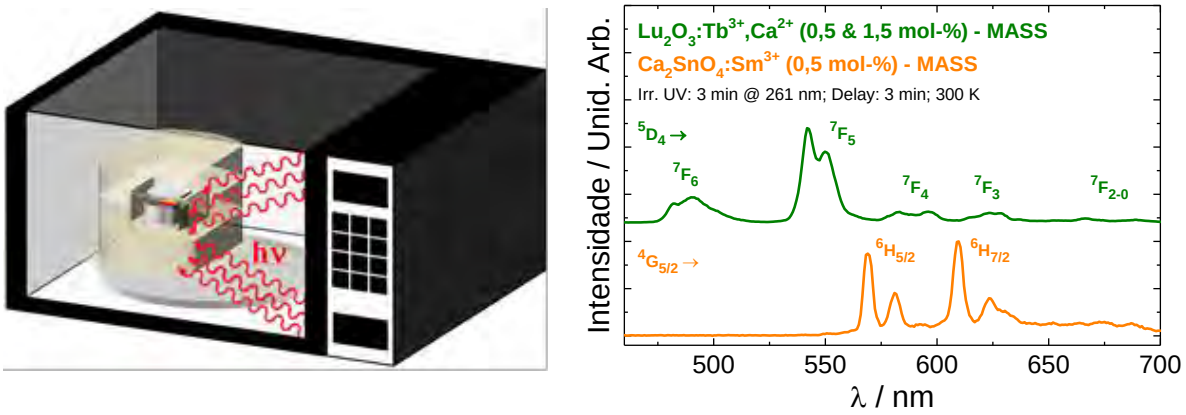

Figure: Microwave-assisted solid state synthesis device (left) and persistent luminescence spectra of $Lu_2O_3:Tb^{3+},Ca^{2+}$ and $Ca_2SnO_4:Sm^{3+}$ (right).

Keywords: Microwave-assisted solid-state synthesis, Persistent luminescence, Rare earths.

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References

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