Tetravalent Manganese-Activated Near-Infrared Persistent Phosphors

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Persistent luminescence, also named long afterglow, is an interesting optical phenomenon where a phosphor continues emitting for an appreciable time after the excitation source has finished. Persistent phosphors or the glow-in-the-dark materials emitting in the visible spectral region have drawn extensive attention and have achieved commercial success, for instance, $SrAl_2O_4:Eu^{2+}$, Dy^{3+} with green emission and $CaAl_2O_4:Eu^{2+}$, Nd^{3+} with blue emission. Exploring persistent phosphors in wavelengths beyond the visible spectral region, that is, in the near-infrared (650 to 900 nm), has been of great significance due to many promising advanced applications, ranging from night-vision surveillance to medical imaging. In particular, the self-sustained feature of near-infrared emitting persistent luminescence enables bio-imaging without external excitation, without autofluorescence and with high signal-to-noise ratio. This state-of-the-art bio-imaging technology has motivated the development of near-infrared emitting persistent phosphors with high radiance and long duration [1].

Here, double perovskite type $La_2MgGeO_6:Mn^{4+}$ phosphors were successfully prepared by an energy-saving microwave-assisted solid state reaction method. This versatile synthesis is regarded as a rapid and cost-effective method to yield products with high homogeneity and purity. The $La_2MgGeO_6:Mn^{4+}$ materials show strong emission in the deep-red and near-infrared spectral region, assigned to the transitions of tetravalent manganese ions. We are presenting a series of temperature dependent charging, afterglow and thermoluminescence measurements trying to give clear information on the afterglow behavior and shed more light on the nature of the traps responsible for the persistent luminescence.

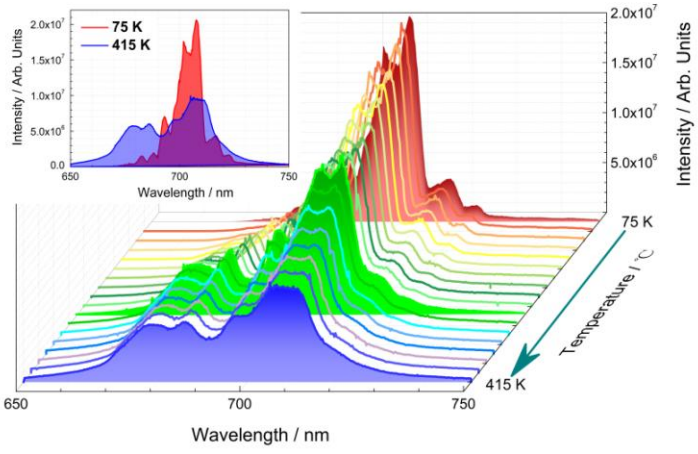

Fig. 1. Temperature dependent photoluminescence of Mn^{4+} doped La_2MgGeO_6 phosphor.

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