Spectroscopic studies of $CdSiO_3:R^{3+}$ persistent luminescence phosphors

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The persistent luminescence materials have received special attention lately due to their significant applications in emergency signs, micro defect sensing, optoelectronics for image storage, detectors of high energy radiation and thermal sensors. Despite the recent advances in preparing these materials, the mechanism of the persistent luminescence is still unclear, requiring multidisciplinary studies involving solid state sciences, materials engineering as well as different spectroscopy methods. The most studied persistent luminescence phosphors are those containing Eu^{2+} ion as the emitting center. In some systems, persistent luminescence is observed to originate from trivalent rare earth ions (R^{3+}), however. In this work, the spectroscopic properties of $CdSiO_3:R^{3+}$ are studied.

The phosphors were prepared with a solid state reaction at 950 °C with the R^{3+} concentration of 1 mole-% of the cadmium amount. The luminescence spectra provided important data such as the energy of the interconfigurational transition $4f^8 \rightarrow 4f^7 5d^1$ of Tb^{3+}, as well as the charge transfer band energy of the Eu^{3+} ion. Furthermore, it was observed important behaviors in the photoluminescence with the temperature, as it can be seen in Fig. 1, where only the intraconfigurational transitions of Tb^{3+} are observed at 298 K, while at 77 K the host emission is predominant. This set of results, together with the structural data, shed further light on the development of the persistent luminescence mechanism from the $CdSiO_3:R^{3+}$ materials.

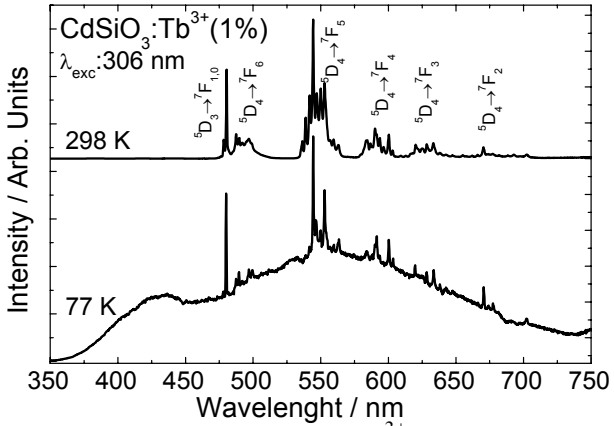

Fig. 1. Emission spectra of $CdSiO_3:Tb^{3+}$ at different temperatures.

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