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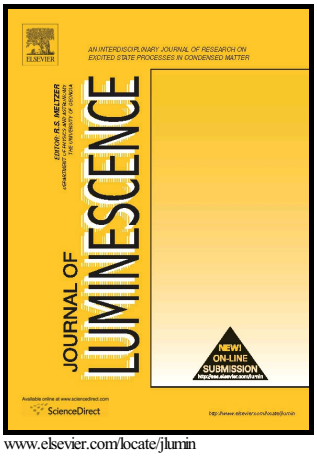

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Energy transfer between terbium and europium ions in barium orthosilicate phosphors obtained from sol-gel route

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Abstract

The present paper reports on the energy transfer mechanism between Eu^{3+} and Tb^{3+} in barium orthosilicate obtained from the sol-gel route, when both activators concentration is varied. The synthetic methodology was adjusted to provide high crystalline and monophasic Ba_2SiO_4. In the emission spectra under 250 nm excitation, both Eu^{3+} ($^5D_0 \rightarrow {}^7F_J$) and Tb^{3+} ($^5D_3 \rightarrow {}^7F_J$ and $^5D_4 \rightarrow {}^7F_J$) transitions can be observed at low Eu^{3+} doping concentrations with an unexpected and intense blue emission from Tb^{3+} . However, when the Eu^{3+} content is higher than that of the Tb^{3+}, just the Eu^{3+} emission is noticed. Also, it is possible to tune the phosphor emission from red to pink by varying the Eu^{3+} and Tb^{3+} content. From the excitation spectra, we inferred that energy transfer (ET) from Tb^{3+} to Eu^{3+} occurs at any doping situation, nonetheless, the opposite process happens just when both activators amount is similar. An approach using the Tb^{3+} and Eu^{3+} lifetimes and the Eu^{3+} quantum efficiency confirms this observation, indicating that not only the matrix act as sensitizer to the Eu^{3+} ions, but also Tb^{3+} ions contribute by increasing the Eu^{3+} quantum efficiency in up to 20 %. Finally, by using the Van Uitert theory, it was found for this system that the ET between the two rare-earth ions is dominated by the dipole-dipole mechanism.

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