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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  $\text{Eu}^{3+}$  and  $\text{Tb}^{3+}$  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  $\text{Ba}_2\text{SiO}_4$ . In the emission spectra under 250 nm excitation, both  $\text{Eu}^{3+}$  ( $^5\text{D}_0 \rightarrow ^7\text{F}_J$ ) and  $\text{Tb}^{3+}$  ( $^5\text{D}_3 \rightarrow ^7\text{F}_J$  and  $^5\text{D}_4 \rightarrow ^7\text{F}_J$ ) transitions can be observed at low  $\text{Eu}^{3+}$  doping concentrations with an unexpected and intense blue emission from  $\text{Tb}^{3+}$ . However, when the  $\text{Eu}^{3+}$  content is higher than that of the  $\text{Tb}^{3+}$ , just the  $\text{Eu}^{3+}$  emission is noticed. Also, it is possible to tune the phosphor emission from red to pink by varying the  $\text{Eu}^{3+}$  and  $\text{Tb}^{3+}$  content. From the excitation spectra, we inferred that energy transfer (ET) from  $\text{Tb}^{3+}$  to  $\text{Eu}^{3+}$  occurs at any doping situation, nonetheless, the opposite process happens just when both activators amount is similar. An approach using the  $\text{Tb}^{3+}$  and  $\text{Eu}^{3+}$  lifetimes and the  $\text{Eu}^{3+}$  quantum efficiency confirms this observation, indicating that not only the matrix act as sensitizer to the  $\text{Eu}^{3+}$  ions, but also  $\text{Tb}^{3+}$  ions contribute by increasing the  $\text{Eu}^{3+}$  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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