*Inorganica Chimica Acta*, *139* (1987) 307

# Peculiar Fluorescence of $Eu^{3+}$ in Oxyapatites*

B. PIRIOU†, D. FAHMI, J. DEXPERT-GHYS

*Laboratoire des Eléments de Transition dans les Solides, C.N.R.S., 1 place Aristide Briand, F-92195 Meudon Cédex, France*

A. TAITAI and J. L. LACOUT

*Laboratoire de Physicochimie des Solides, I.N.P.T., 38 rue des 36 ponts, F-31400 Toulouse, France*

## Abstract

The continuous solid solution $Ca_{10-x}Eu_x(PO_4)_6$-$(O_{1+x/2}\square_{1-x/2}$, with $0.05 \leqslant x \leqslant 2$, was studied by the $Eu^{3+}$ fluorescence at 300 and 77 K. The emission mainly arises from the $^5D_0$ level. The dependence upon the composition shows that $Eu^{3+}$ ions occupy preferentially site II. $Eu^{3+}$ ions located in site I are only characterized for $x > 1$. Due to the occurrence of vacancies the lines are broad.

The site selective laser excitation of $Eu^{3+}$ in site II allows us to classify them into two families. A structural model is proposed as explanation.

The spectra are unusual because of the high value of the $^5D_0$ level ($\simeq$17 500 $cm^{-1}$), the large $^7F_1$ splitting and the very strong $^5D_0 \rightarrow {}^7F_0$ emission line. The covalent character of the $Eu^{3+}$–$O^{2-}$ bond correlated to a strong crystal field of nearly $C_{\infty v}$ symmetry allows us to assign the $^5D_0 \rightarrow {}^7F_{1,2}$ lines. Discussion of this exceptional behavior of $Eu^{3+}$ is given in terms of *J*-mixing.

---

*Abstract of a paper presented at the Second International Conference on the Basic and Applied Chemistry of f-Transition (Lanthanide and Actinide) and Related Elements (2nd ICLA), Lisbon, Portugal, April 6–10, 1987. The extended paper will be published in *J. Luminescence*, 1987.

†Author to whom correspondence should be addressed.

0020-1693/87/$3.50