

Supporting information (SI) for

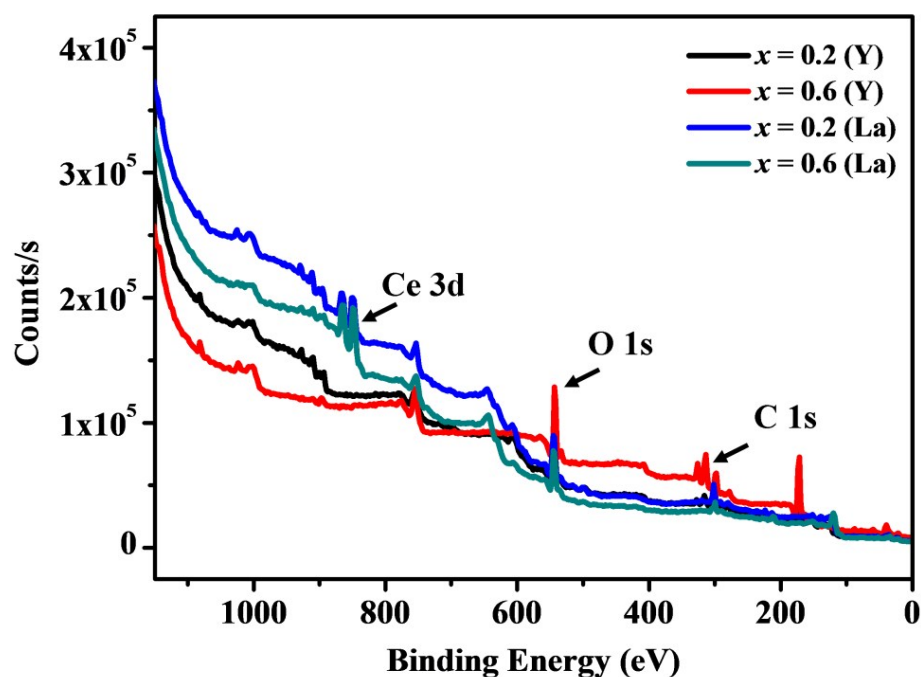
**Influence of local structure on photoluminescence properties of  $\text{Eu}^{3+}$  doped  $\text{CeO}_2$  red phosphors through induced oxygen vacancies by contrasting rare earth substitutions**

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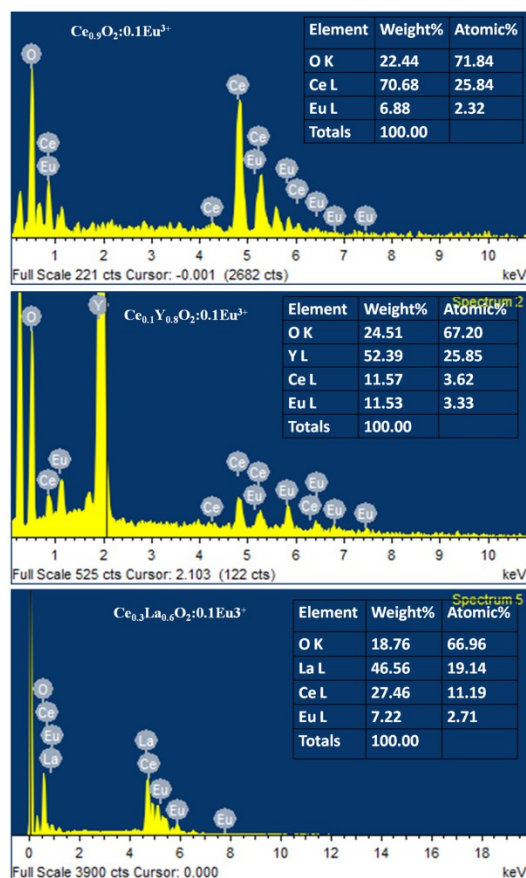
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**Figure S1.**



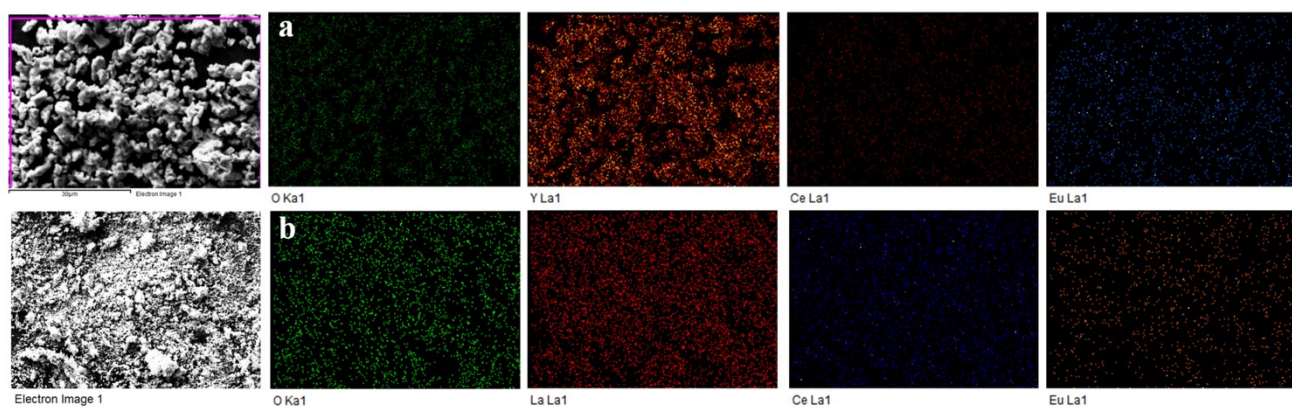
**Fig. S1** XPS survey spectra of  $\text{Ce}_{0.9-x}\text{RE}_x\text{O}_{2-\delta}:0.1\text{Eu}^{3+}$  (RE = Y and La; x = 0.2 and 0.6) red phosphors.

**Figure S2.**



**Fig. S2.** EDS spectra of  $\text{Ce}_{0.9}\text{O}_{2.8}:0.1\text{Eu}^{3+}$ ,  $\text{Ce}_{0.1}\text{Y}_{0.8}\text{O}_{2.8}:0.1\text{Eu}^{3+}$  and  $\text{Ce}_{0.3}\text{La}_{0.6}\text{O}_{2.8}:0.1\text{Eu}^{3+}$  red phosphors which identifies the presence of all expected elements.

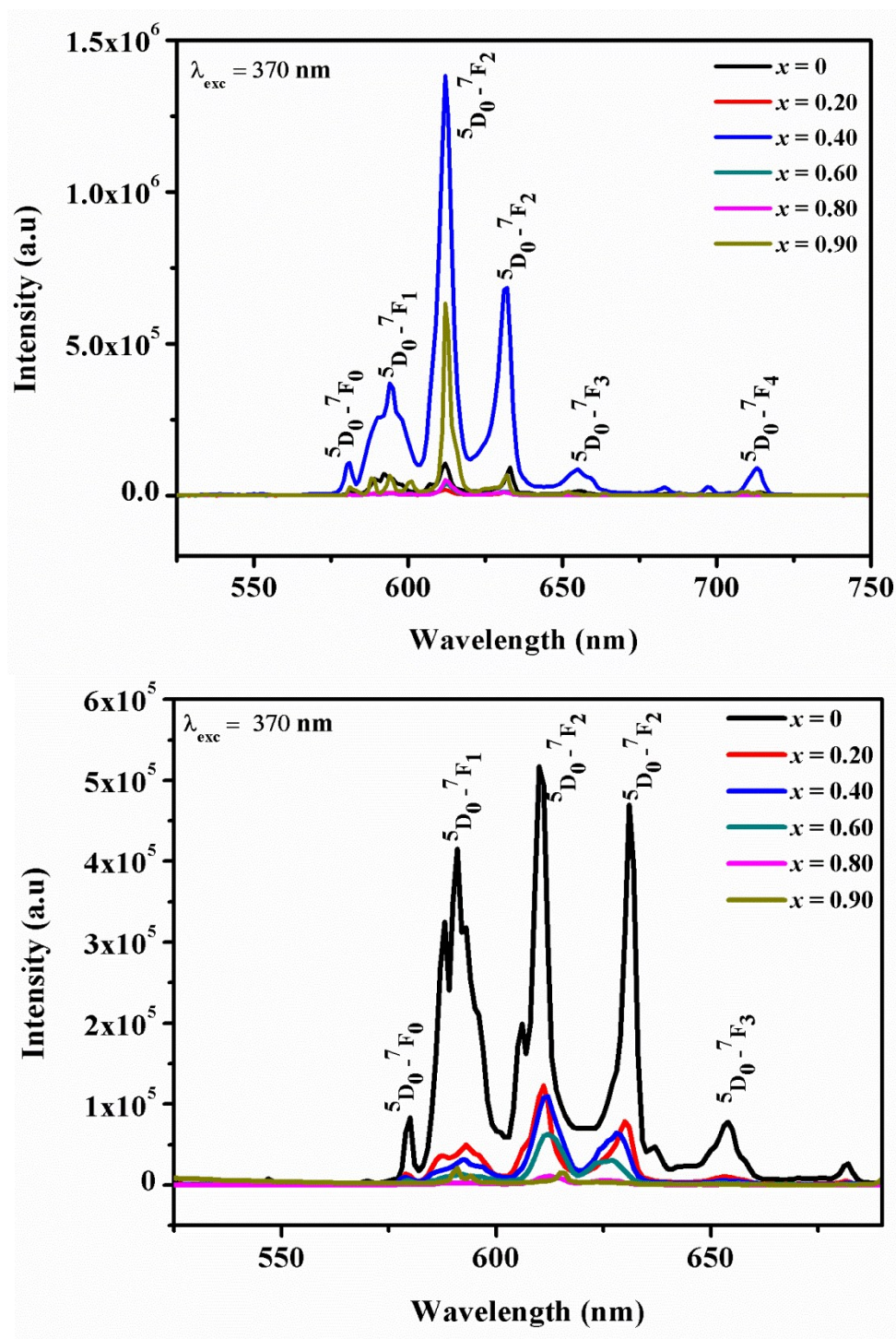
**Figure S3.**



**Fig. S3** Elemental mapping of typical a)  $\text{Ce}_{0.1}\text{Y}_{0.8}\text{O}_{2-\delta}:\text{0.1Eu}^{3+}$  and b)  $\text{Ce}_{0.3}\text{La}_{0.6}\text{O}_{2-\delta}:\text{0.1Eu}^{3+}$  red phosphor. This confirms that all the elements are uniformly distributed in the

lattice.

Figure S4.



**Fig S4.** Emission spectra a)  $\text{Ce}_{0.9-x}\text{Y}_x\text{O}_{2-\delta}:0.1\text{Eu}^{3+}$  b)  $\text{Ce}_{0.9-x}\text{La}_x\text{O}_{2-\delta}:0.1\text{Eu}^{3+}$  where ( $x = 0, 0.2, 0.4, 0.6, 0.8, \text{ and } 0.90$ ) red phosphors excited at 370 nm.