

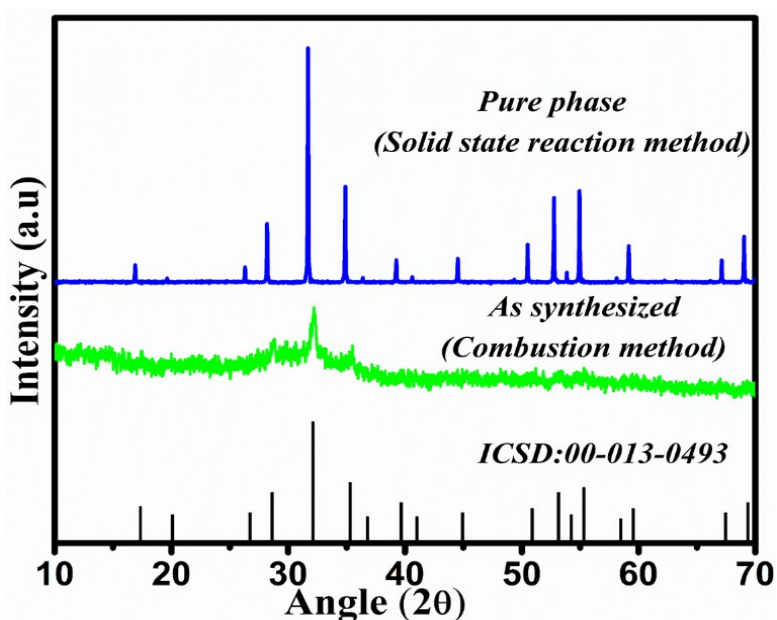
**Probing multimodal light emission from Tb<sup>3+</sup>/Yb<sup>3+</sup> doped garnet nanophosphor for  
lighting applications**

**Neeraj Kumar Mishra<sup>a</sup>, Kumar Shwetabh<sup>a</sup>, Uttam K. Gautam<sup>b</sup>, and Kaushal Kumar<sup>a</sup>**

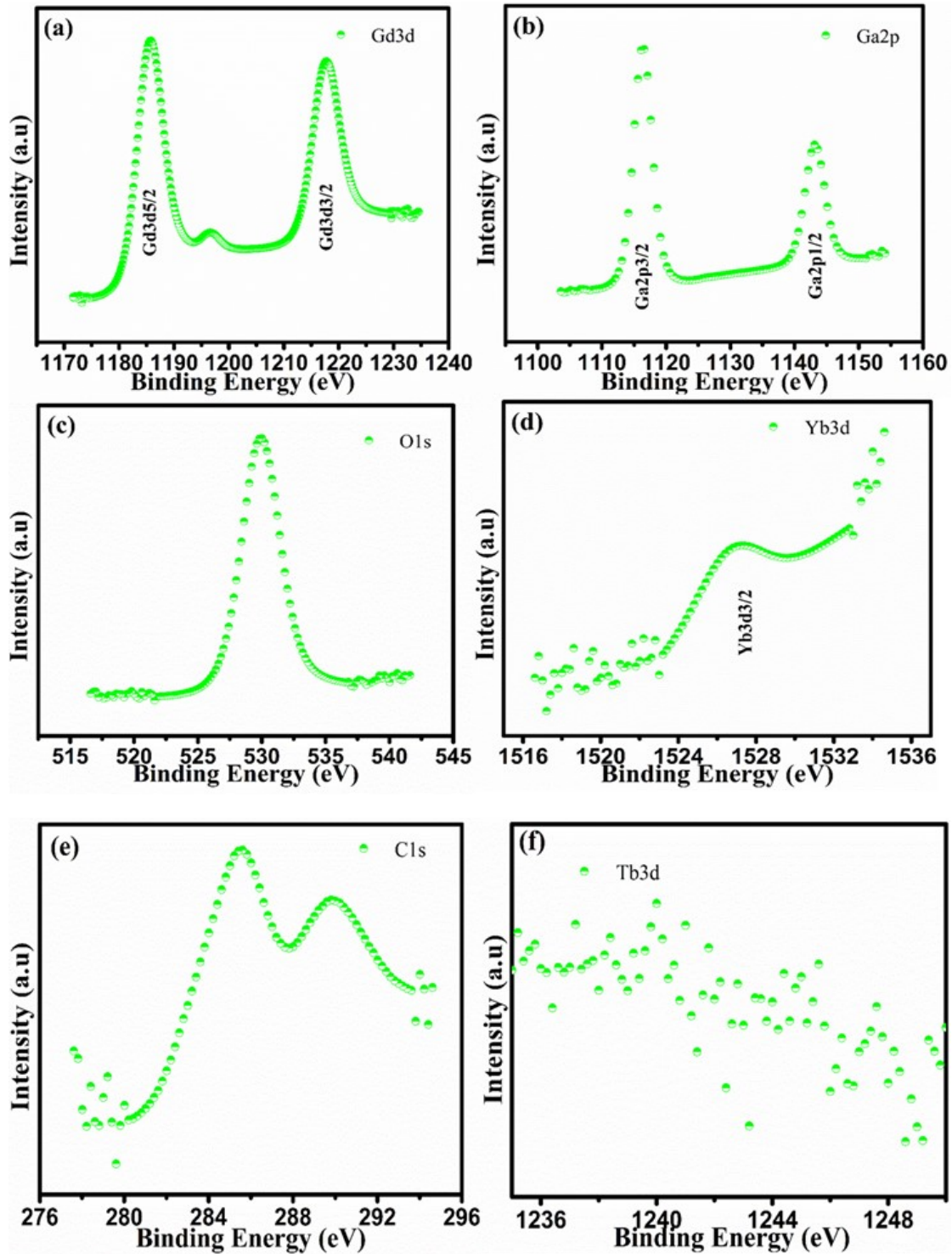
<sup>a</sup>*Optical Materials and Bio-imaging Research Laboratory, Department of Physics, Indian  
Institute of Technology (Indian School of Mines), Dhanbad, 826004, India*

<sup>b</sup>*Raja Ramanna Centre for Advanced Technology Indore, 452013, India*

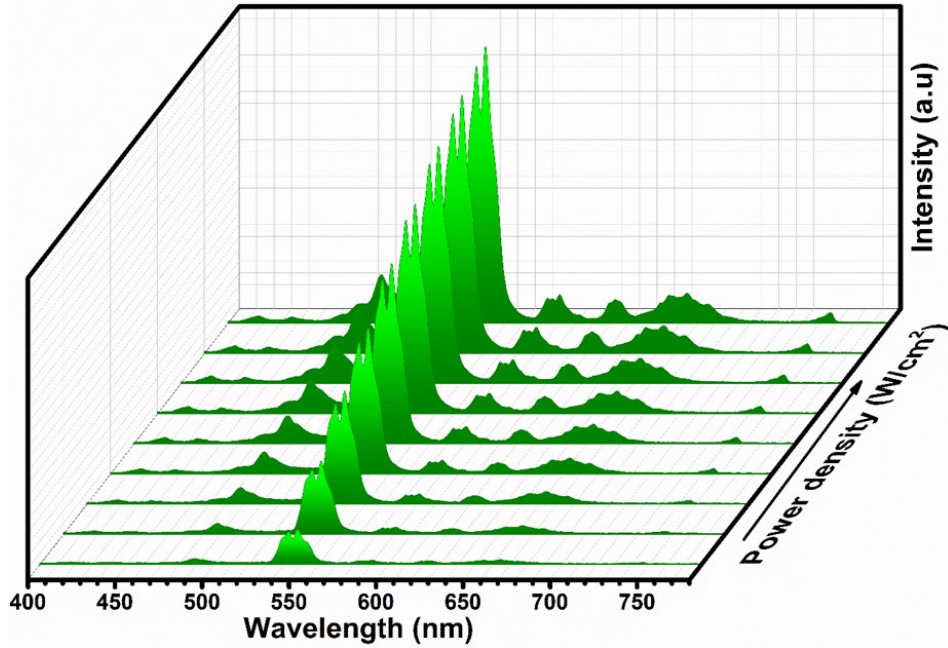
**Supplementary Materials**



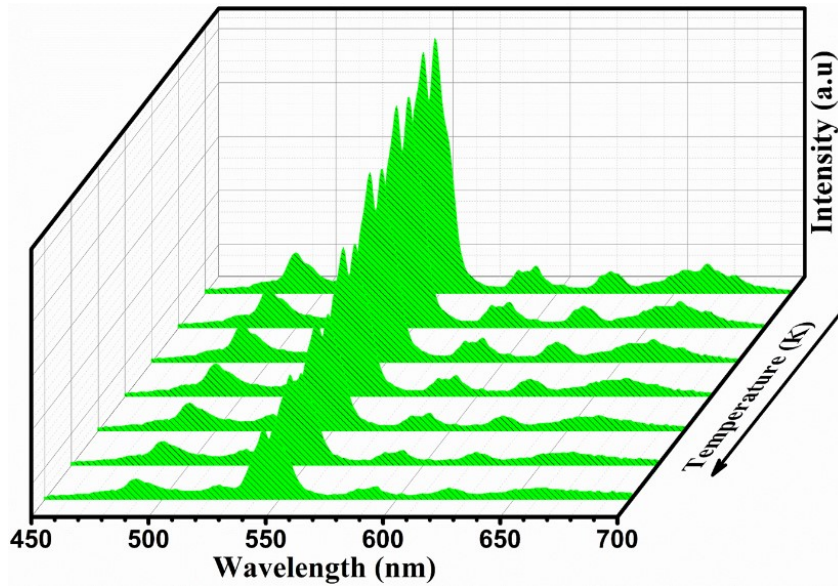
**Figure S. 1.** Powder X-ray diffraction patterns of a pure phase of Gd<sub>3</sub>Ga<sub>5</sub>O<sub>12</sub> prepared through solid-state reaction method (annealed at 1300°C) and pre-heated sample of Gd<sub>3</sub>Ga<sub>5</sub>O<sub>12</sub> obtained after combustion showing amorphous nature with some crystallites formation around 32.2°.



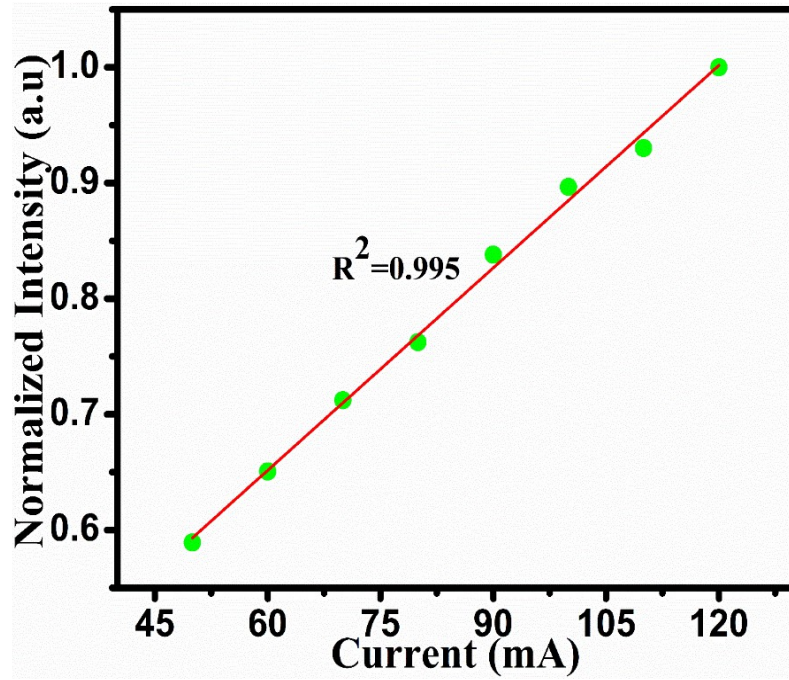
**Figure S. 2.** (a-f) High-resolution elemental scans of Gd3d, Ga2p, O1s, Yb3d, C1s, and Tb3d states, respectively.



**Figure S. 3.** Power dependence upconversion emission spectra of  $\text{Gd}_3\text{Ga}_5\text{O}_{12}:11.0\%\text{Yb}^{3+}1.0\%\text{Tb}^{3+}$  sample measure using NIR 980 nm laser excitation.



**Figure S. 4.** Upconversion emission spectra of  $\text{Gd}_{2.94}\text{Ga}_5\text{O}_{12}:5.0\%\text{Yb}^{3+}1.0\%\text{Tb}^{3+}$  recorded at various temperatures under 980 nm laser excitation, emission intensity decreases without losing the characteristics of emission bands.



**Figure S. 5.** Linear variation in the normalized intensity of emission band around 543 nm of  $\text{Gd}_3\text{Ga}_5\text{O}_{12}:1.0\%\text{Tb}^{3+}$  with the current values showing the stability of the fabricated LED with the current.