SUPPLEMENTARY INFORMATION

Tb^{3+} and Ce^{3+} as a Functional Couple for Enhanced Luminescence in YAG Ceramics for X-Ray Imaging and High-Power White LEDs and Laser Diodes

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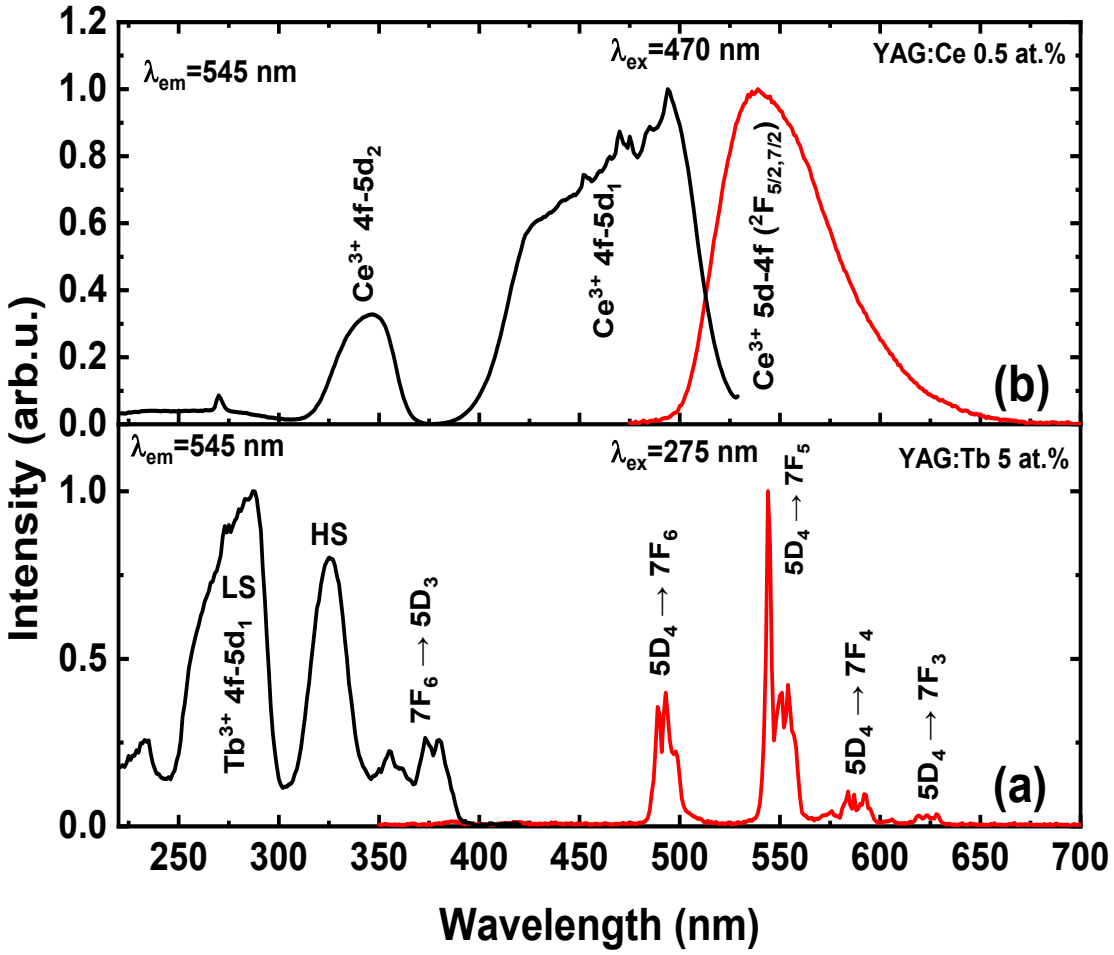

Fig. S1. (a) Photoluminescence excitation (PLE) spectrum monitored at 545 nm and photoluminescence (PL) emission spectrum under 470 nm excitation for Ce^{3+} ions in YAG:Ce ceramics. (b) PLE spectrum monitored at 545 nm and PL emission spectrum under 275 nm excitation for Tb^{3+} ions in YAG:Tb ceramics.

Fig. S1a presents the photoluminescence excitation spectrum monitored at 545 nm and the photoluminescence emission spectrum recorded under 470 nm excitation for YAG:Ce^{3+} (0.5 at.%) ceramics. The PLE spectrum exhibits two prominent excitation bands centered at approximately 360 nm and 460 nm, which are attributed to the 4f → $5d_2$ and 4f → $5d_1$ electronic transitions of Ce^{3+} ions, respectively. Additionally, the enhanced background observed below 300 nm may be associated with defect-related excitation processes, potentially arising from intrinsic lattice imperfections such as Y^{x}_{Al} dislocations, oxygen vacancies, or transitions to higher-lying 5d states of

Ce^{3+}. Upon excitation at 470 nm, the PL spectrum displays a broad asymmetric emission band centered at approximately 545 nm, resulting from the $5d_1 \rightarrow 4f$ radiative transitions of Ce^{3+}, specifically $5d_1 \rightarrow 4f$ ($^2F_{5/2}$, $^2F_{7/2}$). The broadness of this emission is due to the strong coupling of 5d electrons to lattice vibrations and inhomogeneous broadening caused by site variations within the YAG matrix. Fig. S1b PLE spectrum monitored at 545 nm and the PL emission spectrum recorded under 275 nm excitation for YAG:Tb^{3+} (5 at.%) ceramics. The PLE spectrum reveals broad excitation bands located below 400 nm, which are assigned to spin-allowed $4 \rightarrow 5d_1$ transitions of Tb^{3+} ions. These bands exhibit characteristic splitting into low-spin (LS) and high-spin (HS) components due to the influence of crystal field effects on the 5d orbitals. The PL spectrum reveals a series of well-resolved emission lines in the 480–620 nm range, corresponding to the intra-4f transitions from the excited $^5D_4$ state to the lower-lying ^7F_J levels of Tb^{3+} ions. The most intense emission peak is observed at approximately 545 nm, attributed to the $^5D_4 \rightarrow {}^7F_5$ transition, which is responsible for the characteristic green luminescence of Tb^{3+}.