Electronic Supplementary Information

Samarium and manganese incorporation to improve color rendering of LuAG:Ce^{3+} phosphor ceramic for laser-driven lighting: Color-tunable and energy transfer study

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Supplementary Information

The in-line transmission spectra and appearances of polished LuAG:0.04Sm^{3+} and LuAG:0.02Ce^{3+},0.04Sm^{3+} ceramics (1.0 mm thick) were shown in Fig. S3. These samples presented a transparent appearance, and the words behind them could be recognized by naked eyes under daylight. The in-line transmittance of LuAG:0.02Ce^{3+},0.04Sm^{3+} ceramic reached 83.3% at 800 nm, which was higher than that of LuAG:0.04Sm^{3+} ceramic (73.8% at 800 nm). This result implies appropriate rare earth or transition ions doping is in favor of promoting densification process in sintering stage, thus improving optical quality of LuAG:0.02Ce^{3+},0.04Sm^{3+} ceramic. Similar phenomenon has been reported in other literatures.[1, 2] In addition, two broad absorption band located at 340 and 445 nm were originated from 4f-5d^1 and 4f-5d^2 transition of Ce^{3+} in LuAG:0.02Ce^{3+},0.04Sm^{3+} ceramic, respectively. Although most of the intrinsic absorption bands of Sm^{3+} were covered by those of Ce^{3+}, while an absorption centered at 377 nm could also be observed in Ce^{3+}, Sm^{3+} co-doped samples, corresponding to the $^6H_{5/2}$-$^6P_{7/2}$, transition of Sm^{3+} ion.

Supplementary Figures

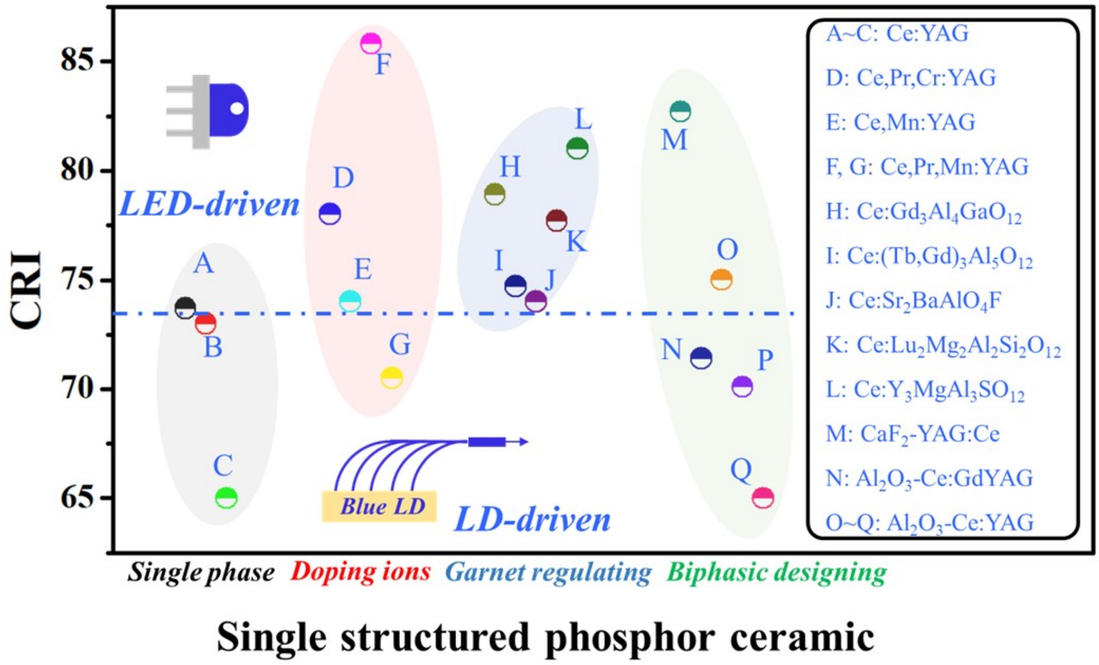

Fig. S1 The CRI value of single-structured phosphor ceramics based on different design strategies

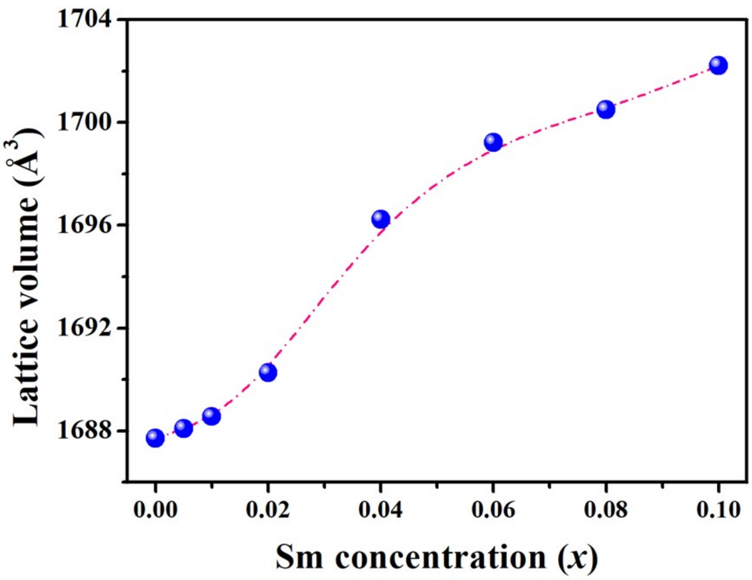

Fig. S2 Evolution of lattice volume depending on the Sm concentration

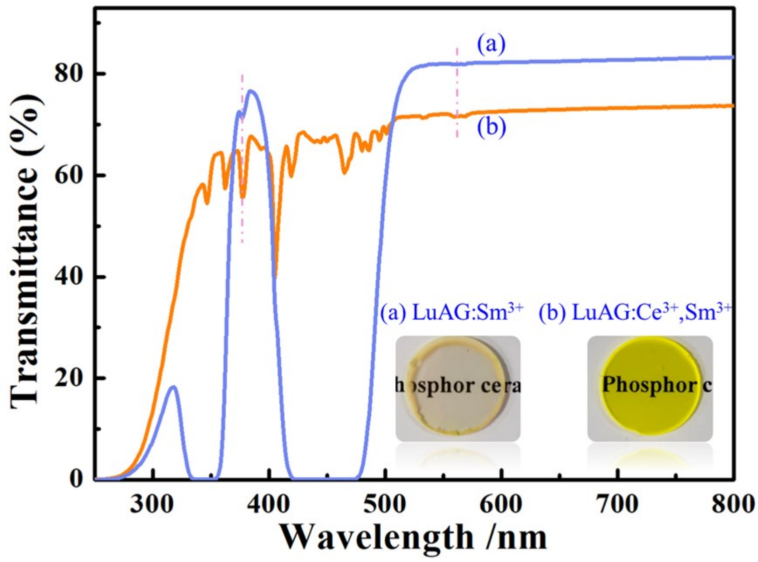

Fig. S3 In-line transmittance of as-prepared LuAG:0.04Sm^{3+} and LuAG:0.02Ce3+,0.04Sm^{3+} ceramics

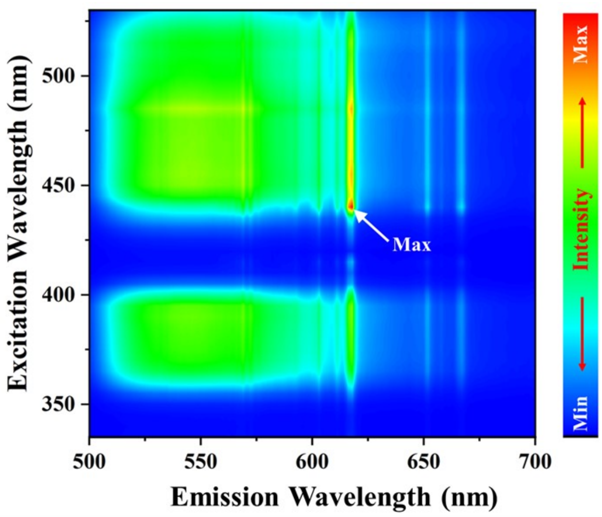

Fig. S4 Excitation-wavelength-dependent emission mappings for representative LuAG:0.02Ce^{3+},0.04Sm^{3+} ceramics.

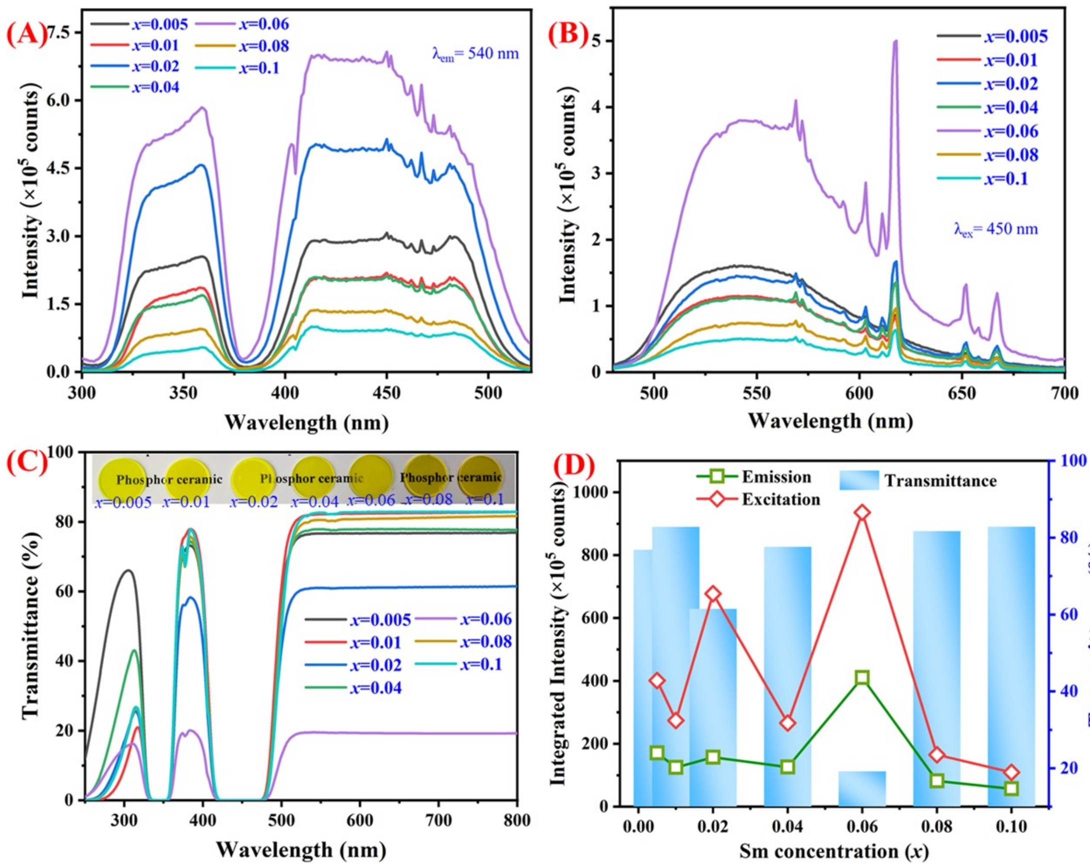

Fig. S5 Excitation-wavelength-dependent emission mappings for representative LuAG:0.02Ce^{3+},0.04Sm^{3+} ceramics.

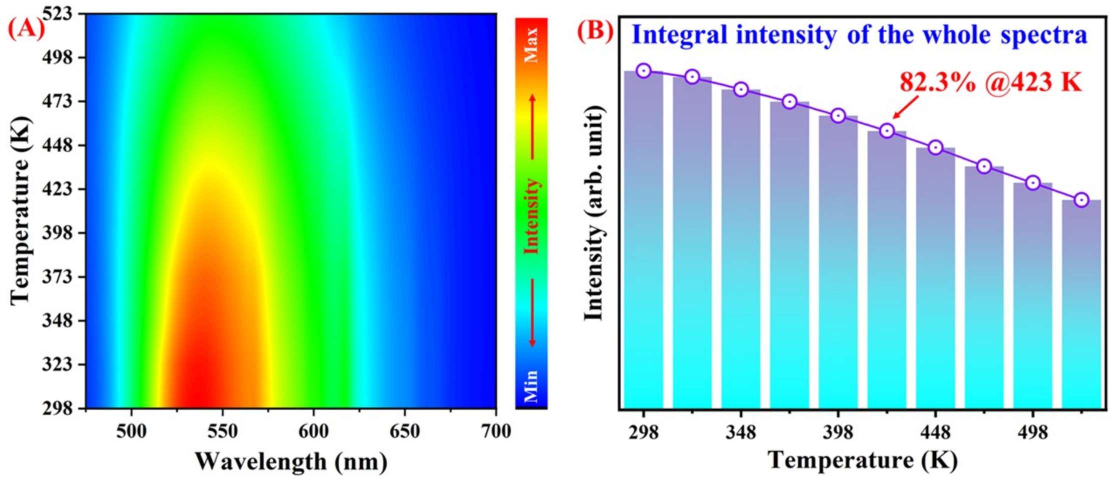

Fig. S6 (A) Temperature-dependent PL spectrum of YAG:0.02Ce^{3+},0.04Sm^{3+} ceramics. Trend of the integral intensity of (B) the whole spectra with the same temperature range.

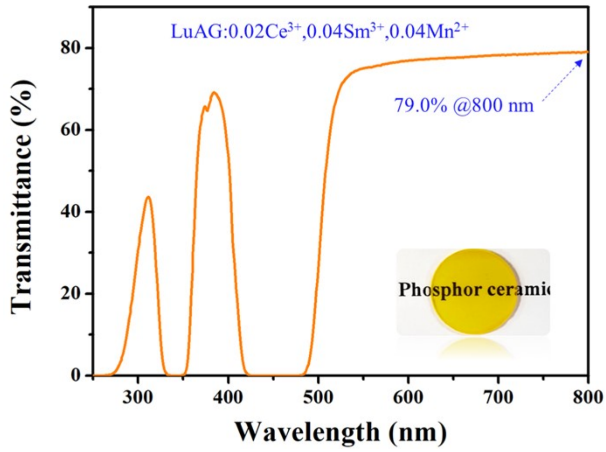

Fig. S7 In-line transmittance and appearance of as-prepared $LuAG:0.02Ce^{3+},0.04Sm^{4+},0.04Mn^{2+}$ ceramic

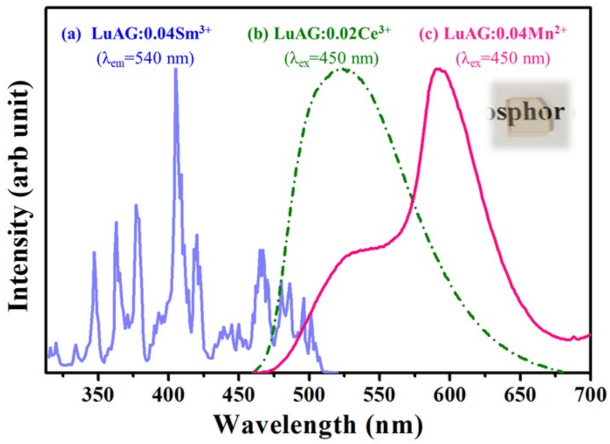

Fig. S8 PLE spectrum (curve a, λ_{em}=618 nm) of $LuAG:0.04Sm^{3+}$ ceramics and PL spectrum of $LuAG:0.02Ce^{3+}$ (curve b, λ_{ex}=450 nm) and $LuAG:0.04Mn^{2+}$ (curve c, λ_{ex}=450 nm) ceramics.

Supplementary References

1. H. Guo, X. Mao, J. Zhang, R. Tian and S. Wang, *Ceramics International*, 2019, **45**, 5080-5086.
2. C. Chen, X. Li, Y. Feng, H. Lin, X. Yi, Y. Tang, S. Zhang and S. Zhou, *Journal of Materials Science*, 2015, **50**, 2517-2521.