

Support information

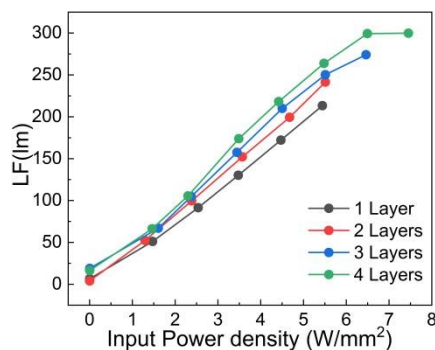


Fig.S1 The LF of CASN with different layers under 455nm LD

As the input power raises from 1 to 8W, an increasing trend can be found for all samples. A maximum LF is found for L4, but the luminous saturation is found when the input power density is 6.49W/mm².

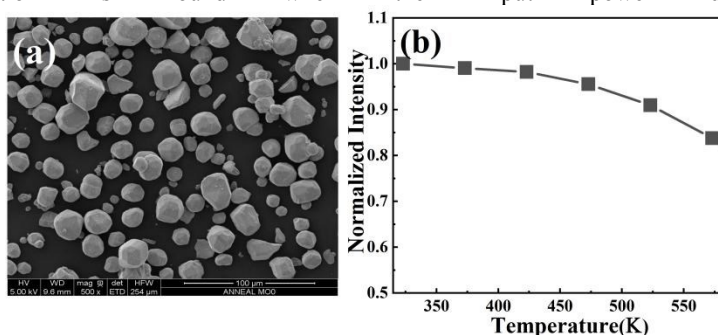


Fig.S2 (a) The SEM pattern of LuAG, **(b)** Normalized PL intensities of LuAG recorded from 323K to 573K

The spherical particles can be found in the SEM picture, and the particle size is about 13 μm. The thermal stability of LuAG is excellent. As shown in **Fig.S2(b)**, 83.75% intensity still present as temperature increased from 323 to 573K.

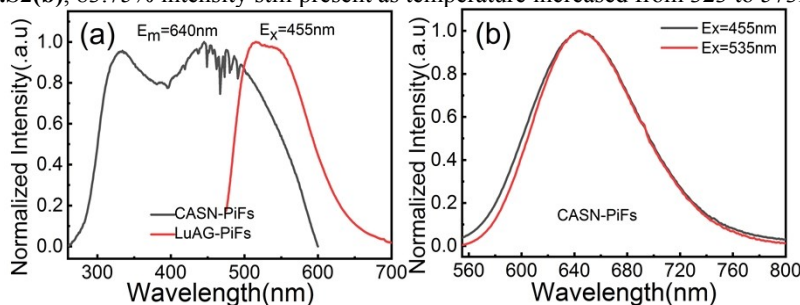


Fig.S3 (a) The normalized PLE spectra of CASN-PiFs and the normalized PL spectra of LuAG-PiFs; **(b)** the normalized PL spectra of CASN-PiFs excited by different excitation wave.

In **Fig.S3(a)** a wide PLE spectra (270-600nm) is detected for CASN PiFs and there is a large overlap between the PL spectrum of LuAG and the PLE spectra of CASN. Compared to the PL spectra excited by 455nm (**Fig.1(b)**), there is also one peak located at 640nm and little divergence is found in PL spectra when the excitation wave is 535nm.

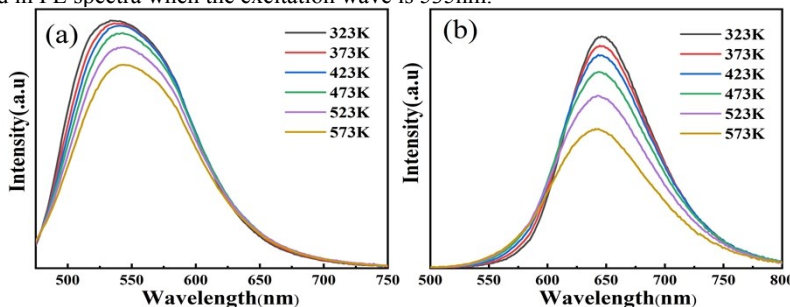


Fig.S4 Temperature-dependent PL spectra of LuAG **(a)** and CASN **(b)** phosphor.

Only one peak is traced for LuAG in **Fig. S4(a)**, which is derived from the Ce in LuAG. As temperature increases, the intensity of PL descends and the emitting peak is red-shift. In **Fig. S4(b)**, a decreased trend is found in the temperature-dependent PL intensity and the emitting peak is blue-shift.