Unveiling the Multifunctional Roles of Hitherto Known Capping Ligand, Oleic Acid, as Blue Emitter and Sensitizer in Tuning the Emission Colour to White in Red-emitting Phosphors

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Fig. S1. Powder XRD patterns of Al\textsubscript{2}O\textsubscript{3} obtained by combustion synthesis and OA-modified Al\textsubscript{2}O\textsubscript{3} by hydrothermal method. All the reflections indexed based on the standard pattern ICDD (\#00-046-1212) confirm the formation of Al\textsubscript{2}O\textsubscript{3} with corundum structure with rhombohedral symmetry.
Fig. S2. FT-IR spectra of OA, Al₂O₃ and Al₂O₃/OA.
Fig. S3. Room temperature PL excitation ($\lambda_{\text{em.}} = 614$ nm) and emission ($\lambda_{\text{exc.}} = 394$ nm) spectra of ZnAl$_{2-x}$Eu$_x$O$_4$ samples revealing the different excitation and emission transitions of Eu$^{3+}$.

Fig. S4. FE-SEM images of (a), (b) ZnAl$_2$O$_4$ and (c), (d) ZnAl$_2$O$_4$/OA.
Fig. S5. TGA traces of ZnAl$_2$O$_4$ and ZnAl$_{1.995}$Eu$_{0.005}$O$_4$/OA.
Fig. S6. The DOS of bulk ZnAl$_2$O$_4$. 
Fig. S7. The optimized structure of (311) surface of ZnAl$_2$O$_4$. Here, orange, pink, and blue, coloured balls represent Zn, A, and O atoms, respectively. The DOS of (311) surface of ZnAl$_2$O$_4$ is also shown.
Fig. S8. XPS core level spectra of Zn-2p (a and b), Al-2p (c and d) and O-1s (e and f) in pristine ZA:Eu$^{3+}$ and ZA:0.01Eu$^{3+}$/OA samples.
Fig. S9. Room temperature PL emission spectra of (a) pristine and OA-modified Y$_2$O$_3$:Eu$^{3+}$ and (b) OA and OA-modified Al$_2$O$_3$. The spectrum of OA was recorded in solution state.