

Supplementary Information

**Charge Compensation in Europium-Doped Hafnia Nanoparticles: Solvothermal Synthesis
and Colloidal Dispersion**

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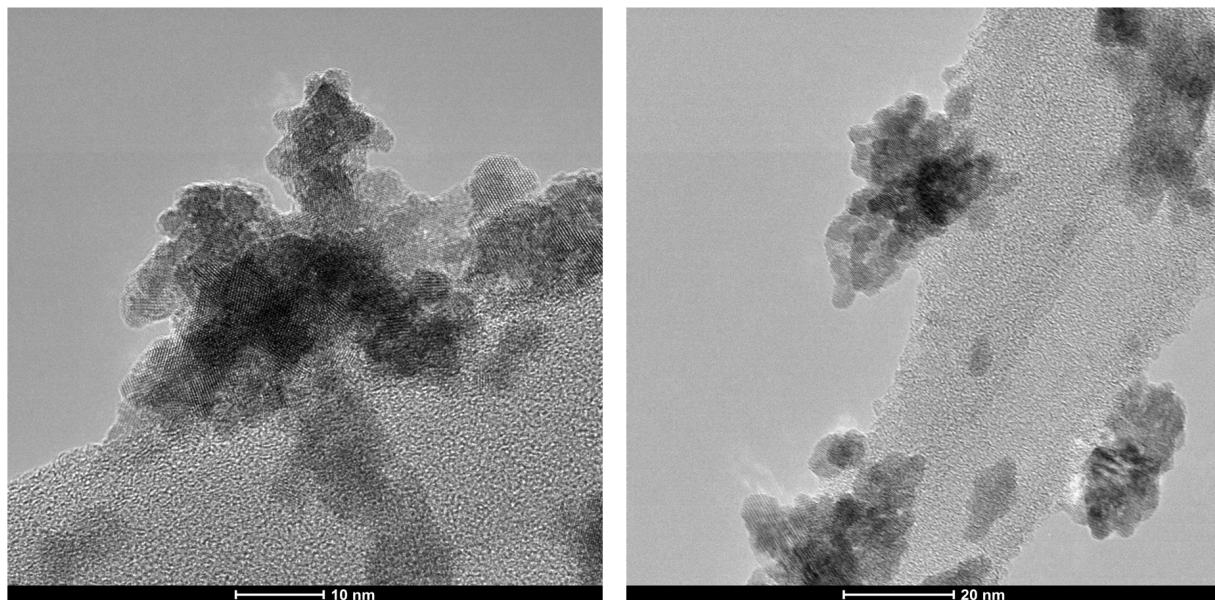


Figure S1. TEM micrographs of HfO_2 : 6 Eu, 6 Nb on lacey carbon showing highly crystalline particles with average crystal size between 5 and 10 nm as well as the occurrence of agglomerates sizing up to few tens of nanometres.

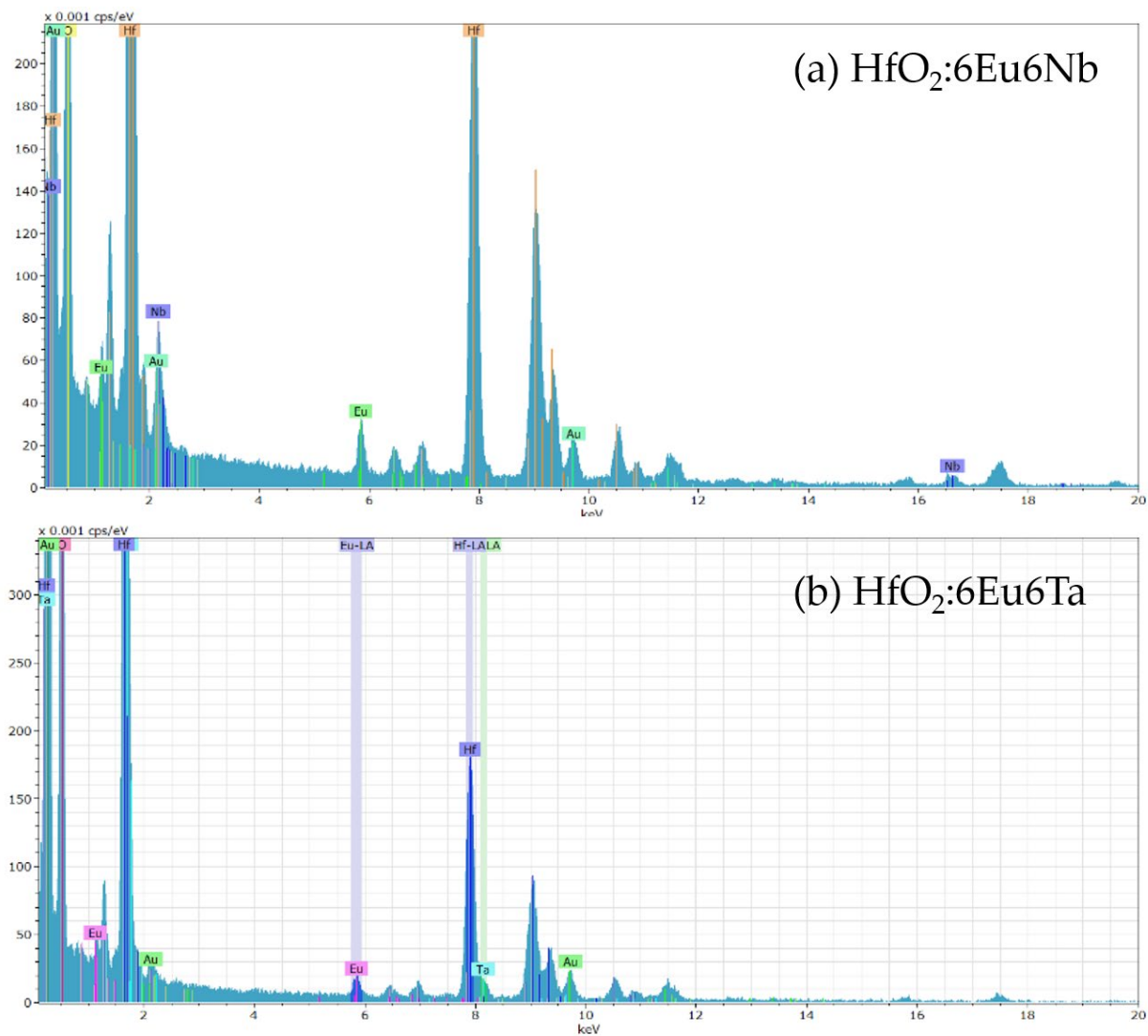


Figure S2. EDS analysis on co-doped nanoparticles. (a) and (b): Energy-dispersive X-ray (EDX) spectra of the sample $\text{HfO}_2:6\text{Eu}, 6\text{Nb}$ and $\text{HfO}_2:6\text{Eu}, 6\text{Ta}$, respectively.

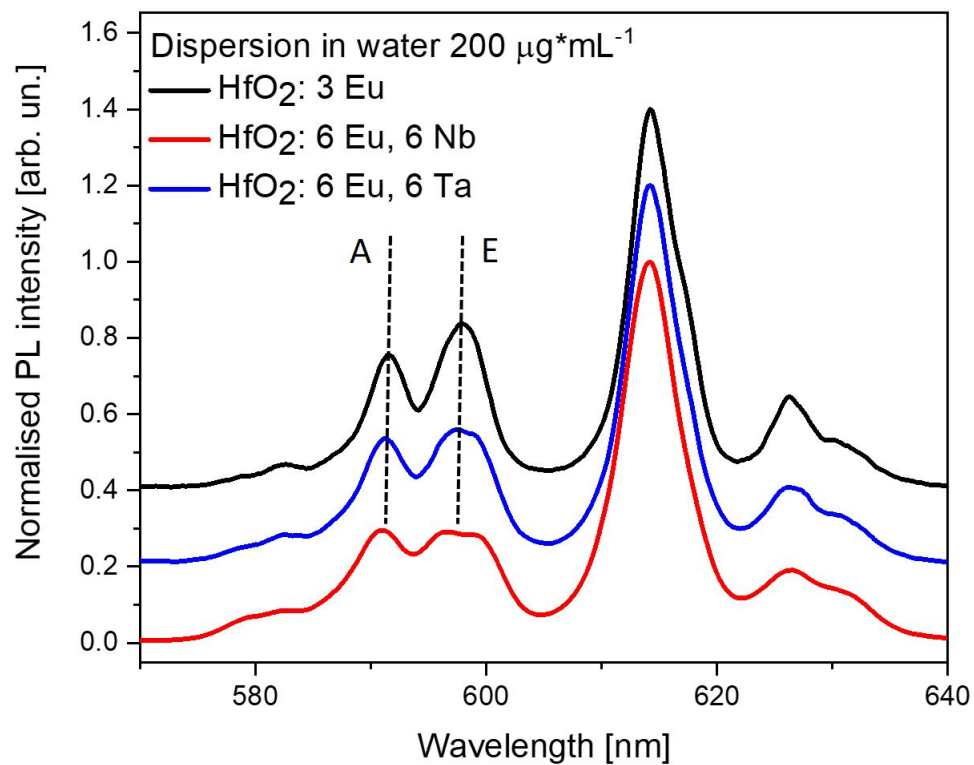
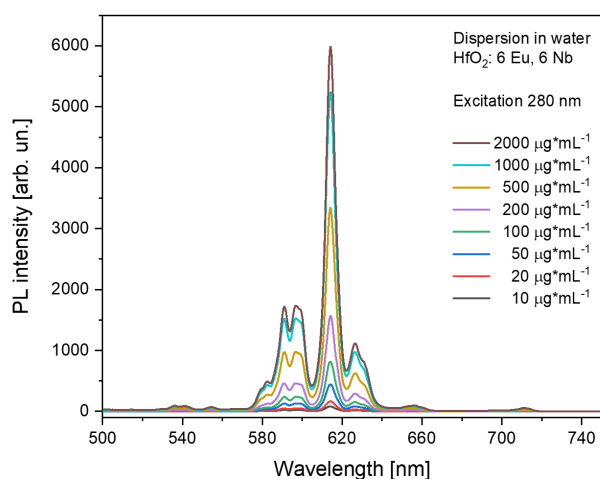
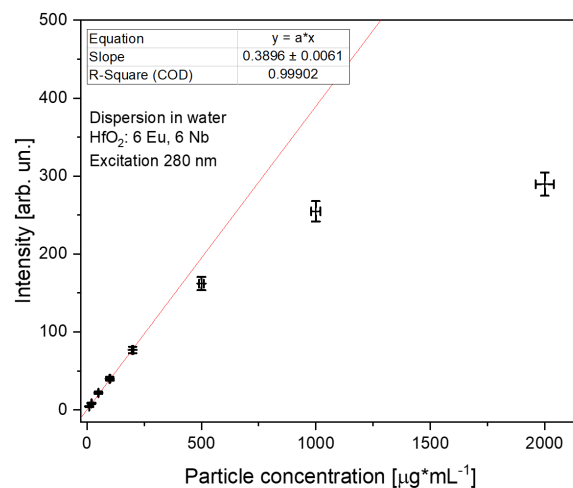


Figure S3. PL spectra of HfO₂: 3 Eu, HfO₂: 6 Eu, 6 Ta, and HfO₂: 6 Eu, 6 Nb excited at 205, 225 and 255 nm, respectively. The dotted lines mark the $^5\text{D}_0 \rightarrow ^7\text{F}_1$ transition showing the splitting of the $^7\text{F}_1$ level attributed to the A and E levels and visible stronger sub-splitting of the E level for Ta and Nd charge compensated HfO₂.



(a)



(b)

Figure S4. Optical characterization of the HfO₂: 6 Eu, 6 Nb water dispersion at different particle loadings. (a) PL excited at 280 nm depending on the particle concentration (b) Integrated intensities (integration range: 515 - 745 nm) and linear fit at different concentrations spanning from 10 to 200 µg*mL⁻¹.