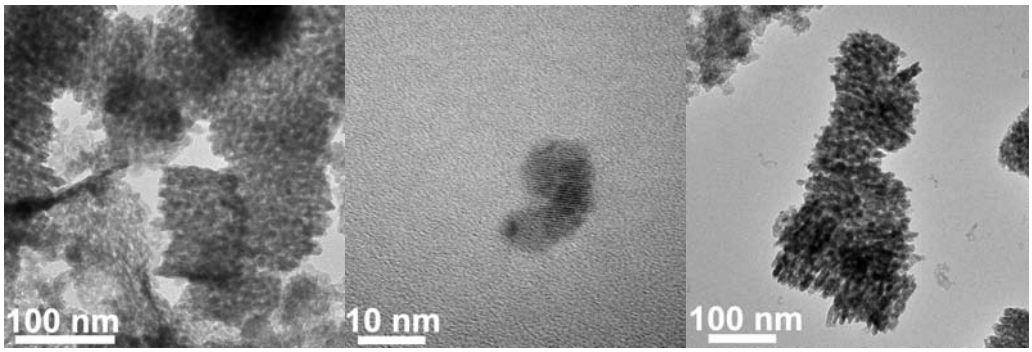
Supporting Information

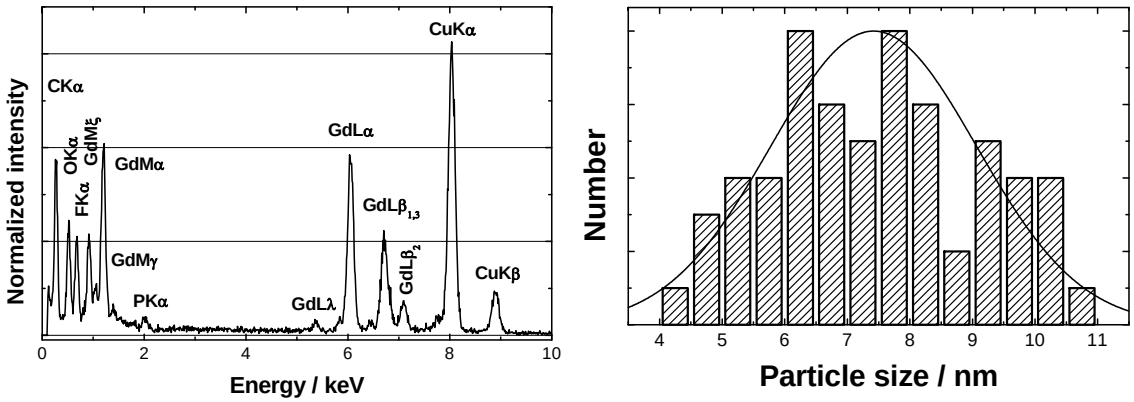
1. Chemicals

$Gd(OAc)_3 \cdot 4\ H_2O$ (99.9 %) and $Eu(OAc)_3 \cdot H_2O$ (99.9 %) were purchased from ABCR. The ionic liquids [choline][H_2PO_4] (98 %) and [choline][BF_4] (99 %) were purchased from Iolitec. The solvents were purchased from Fisher Scientific (dichloromethane, 99.9%), Sigma-Aldrich (Ethanol, abs.) and J. T. Baker (ethylene glycole, 99%). All chemicals were used without further purification.

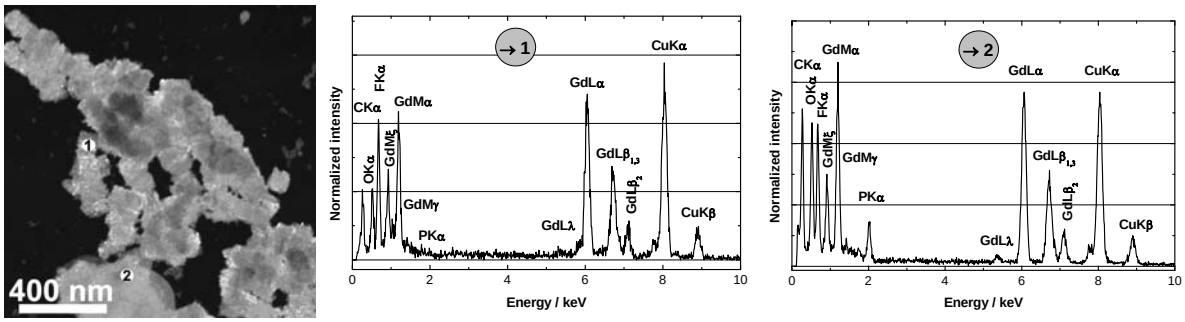
2. Electron Microsopy (TEM and EDX)



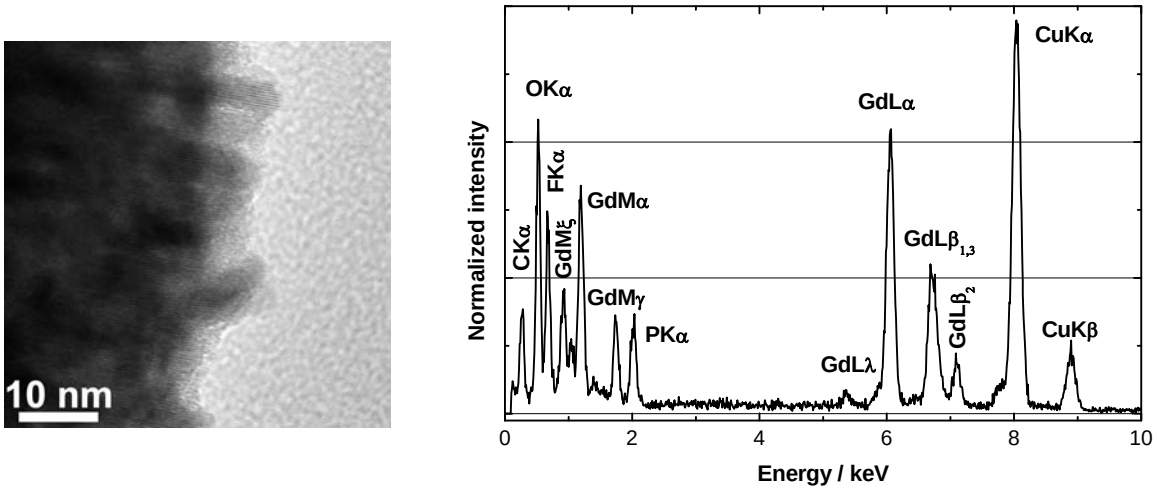
SI-Figure 1. TEM micrographs of the as-prepared, surface modified material.



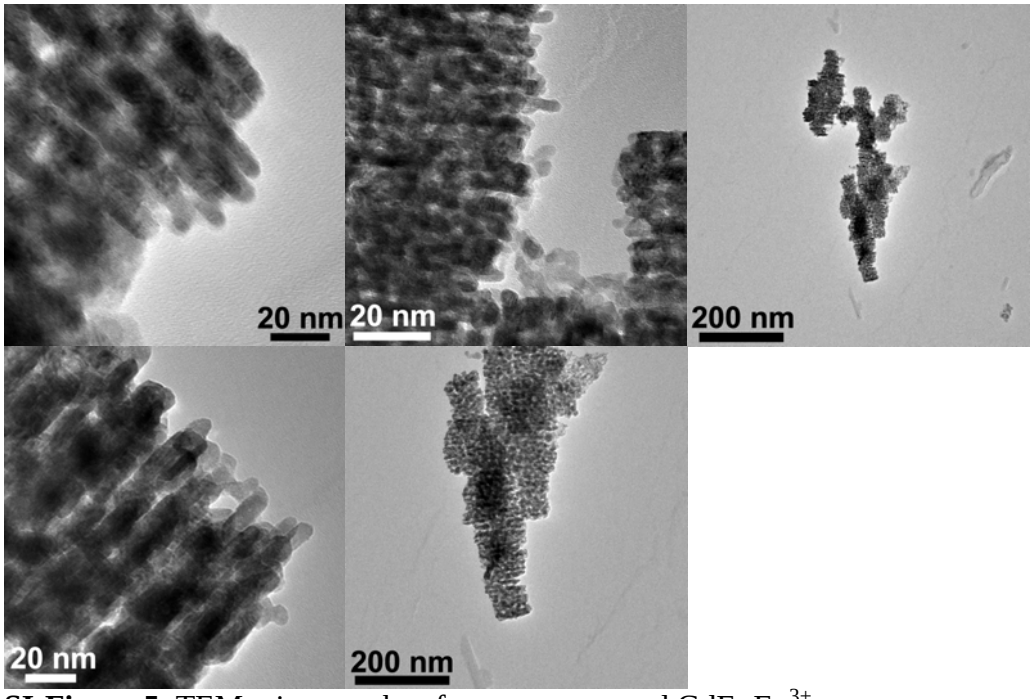
SI-Figure 2. EDX and particle size distribution of the as-prepared, surface modified material.



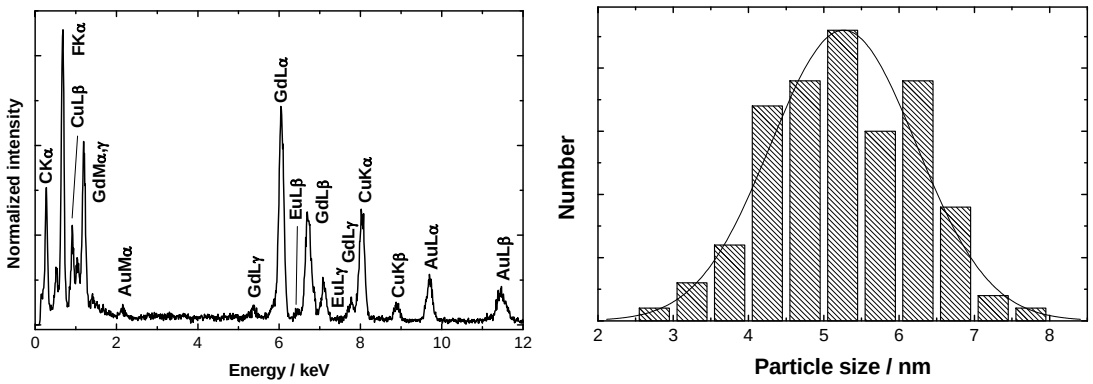
SI-Figure 3. TEM micrograph and corresponding EDX of the as-prepared material illustrating the core-shell structure.



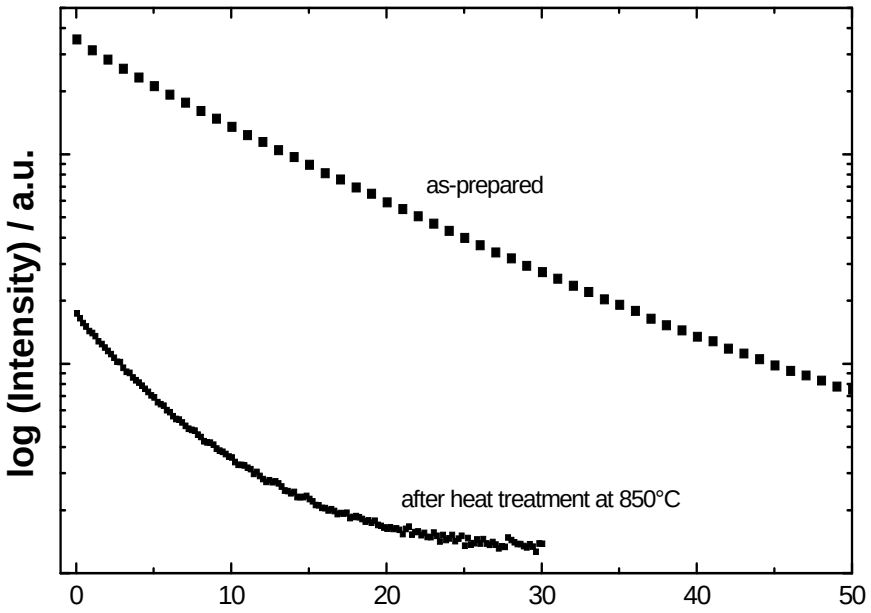
SI-Figure 4. TEM micrograph and EDX of the material after heat treatment at 850 °C.



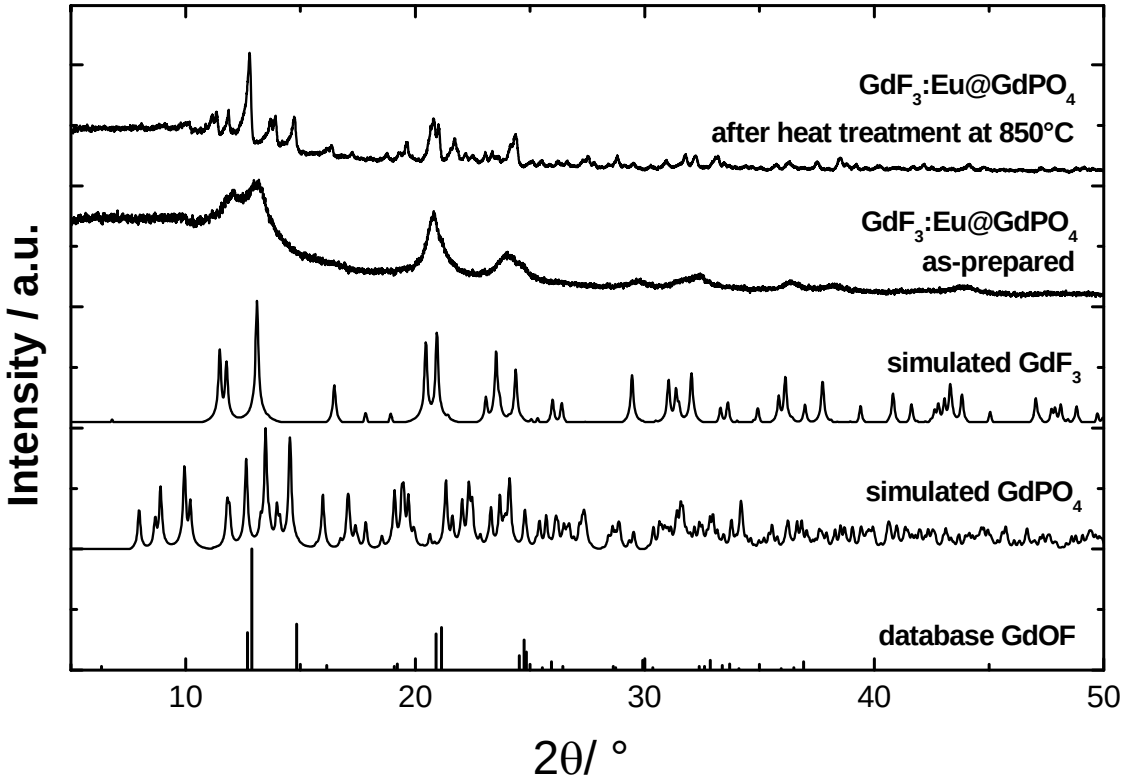
SI-Figure 5. TEM micrographs of pure, non-coated $GdF_3:Eu^{3+}$.



SI-Figure 6. EDX and particle size analysis of pure, non-coated $GdF_3:Eu^{3+}$.



SI-Figure 7. Decay profiles of the as-prepared phosphate coated $GdF_3:Eu^{3+}$ particles and after heat treatment at 850 °C.



SI-Figure 8. Powder X-ray diffraction patterns of the as-prepared material as well as after heat treatment. Theoretical patterns of GdF_3 and $GdPO_4$ simulated from single crystal X-ray data together with the database pattern of GdOF as a potential contamination.