

Supporting Information

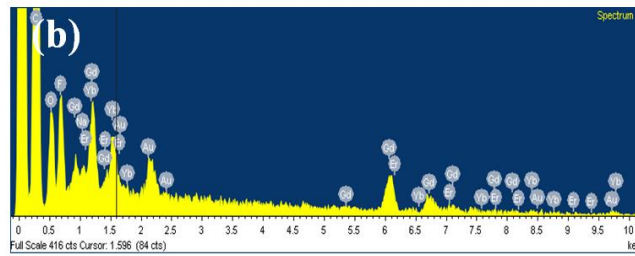
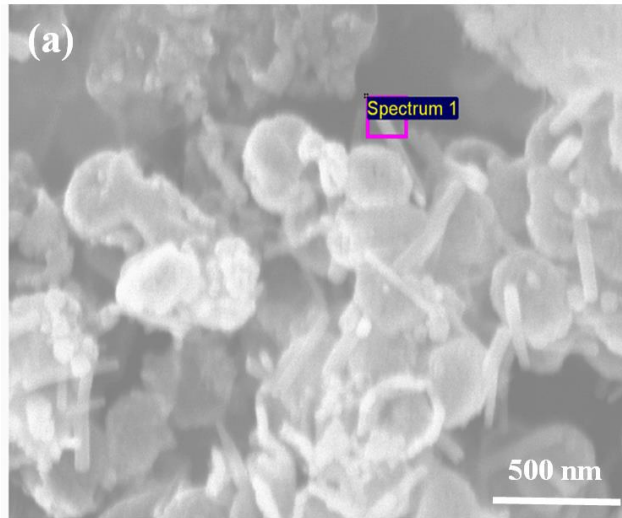
**Dual-Functional Semiconductor-Decorated Upconversion Hollow Spheres
for High Efficiency Dye-Sensitized Solar Cells**

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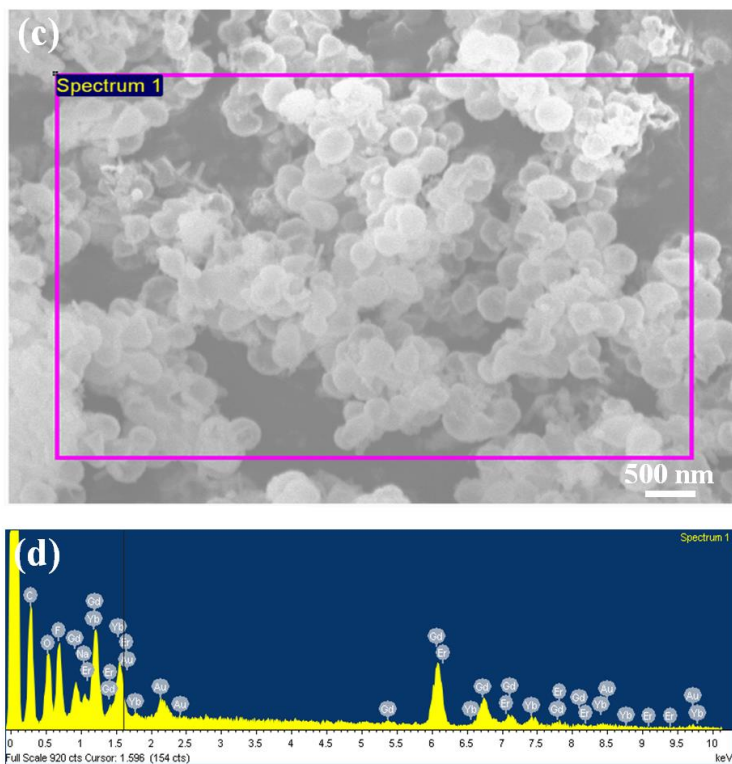
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Element	Atomic%
C K	81.41
O K	9.22
F K	7.30
Na K	0.21
Gd L	1.34
Er L	0.03
Yb L	0.26
Au M	0.25
Totals	



Element	Atomic%
C K	54.84
O K	17.37
F K	16.68
Na K	0.83
Gd L	7.68
Er L	0.28
Yb L	1.78
Au M	0.55
Totals	

Figure S1. EDS analysis on (a-b) the nanorod on the surface of $\text{Na}_x\text{GdF}_y\text{O}_z:\text{Yb/Er}$ hollow spheres, and (c-d) $\text{Na}_x\text{GdF}_y\text{O}_z:\text{Yb/Er}$ hollow spheres. The ratio of Gd, Yb, Er, F and O in both nanorod and $\text{Na}_x\text{GdF}_y\text{O}_z:\text{Yb/Er}$ hollow spheres is the same.

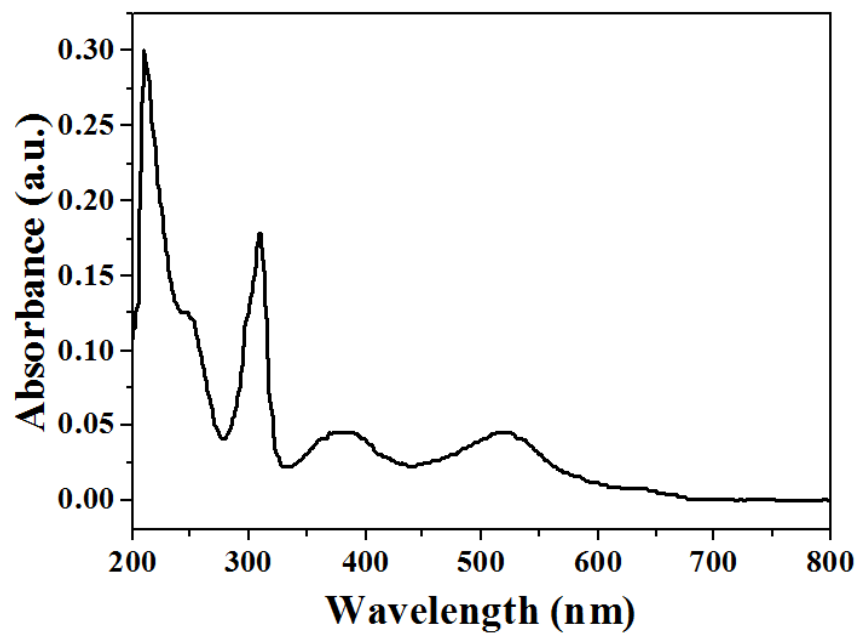


Figure S2. UV-vis spectrum of N719 dye in ethanol. Two main absorption maxima in the visible light range are at 380nm and 512nm, respectively.

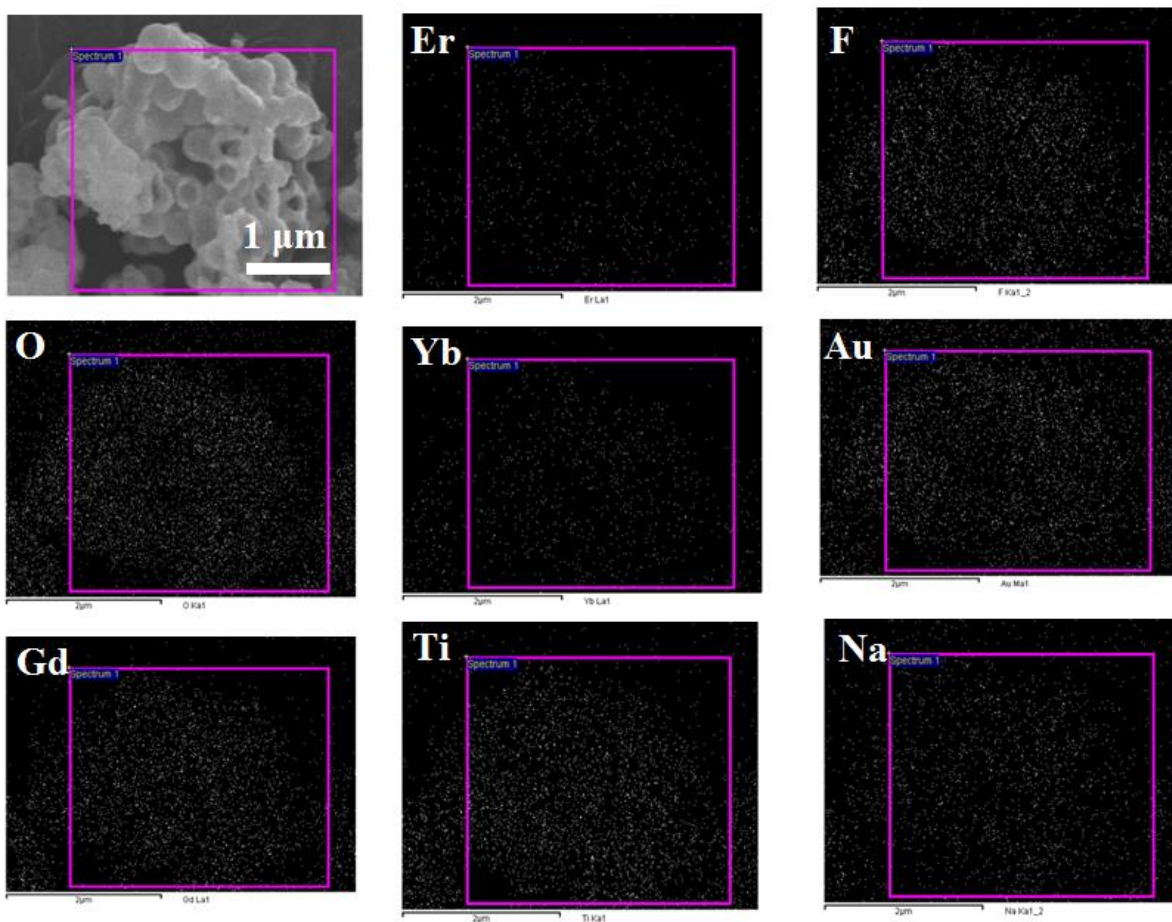


Figure S3. EDS mapping of $\text{Na}_x\text{GdF}_y\text{O}_z:\text{Yb/Er}@ \text{TiO}_2$ submicron hollow spheres.