Synthesis of High Yield, Crystalline and Thermally Stable Rare Earth (Sm, Eu, Gd) Oxide Square Nanoplates for Near-Infrared Light Activatable Photocatalysis

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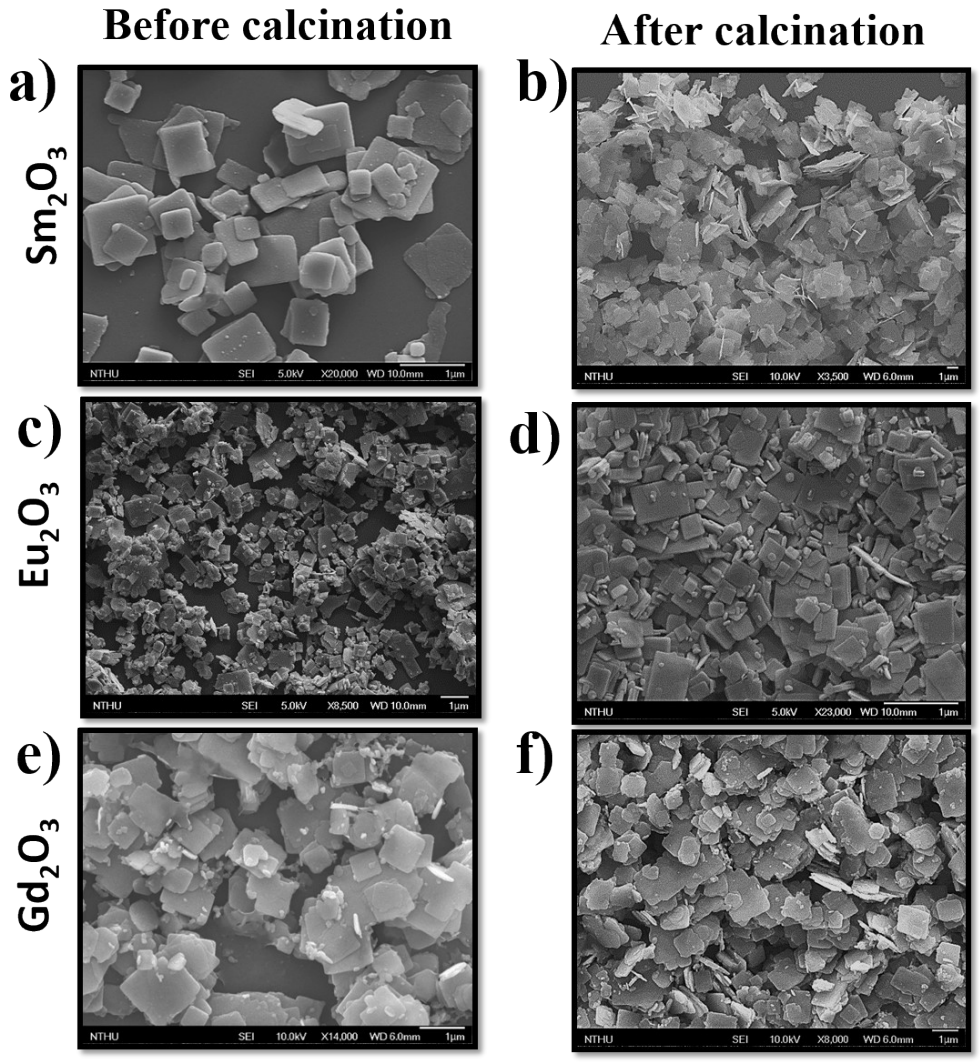

Figure S1 . SEM analysis of REO SNPs (before and after calcination).

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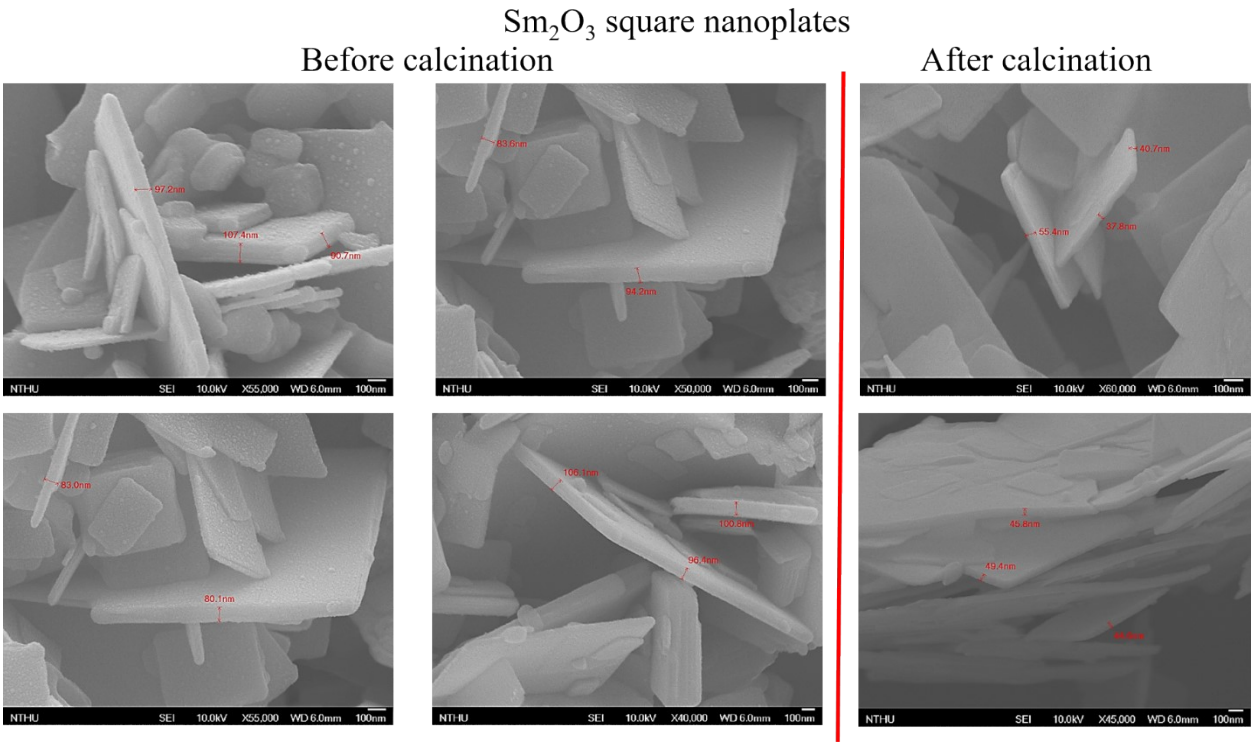
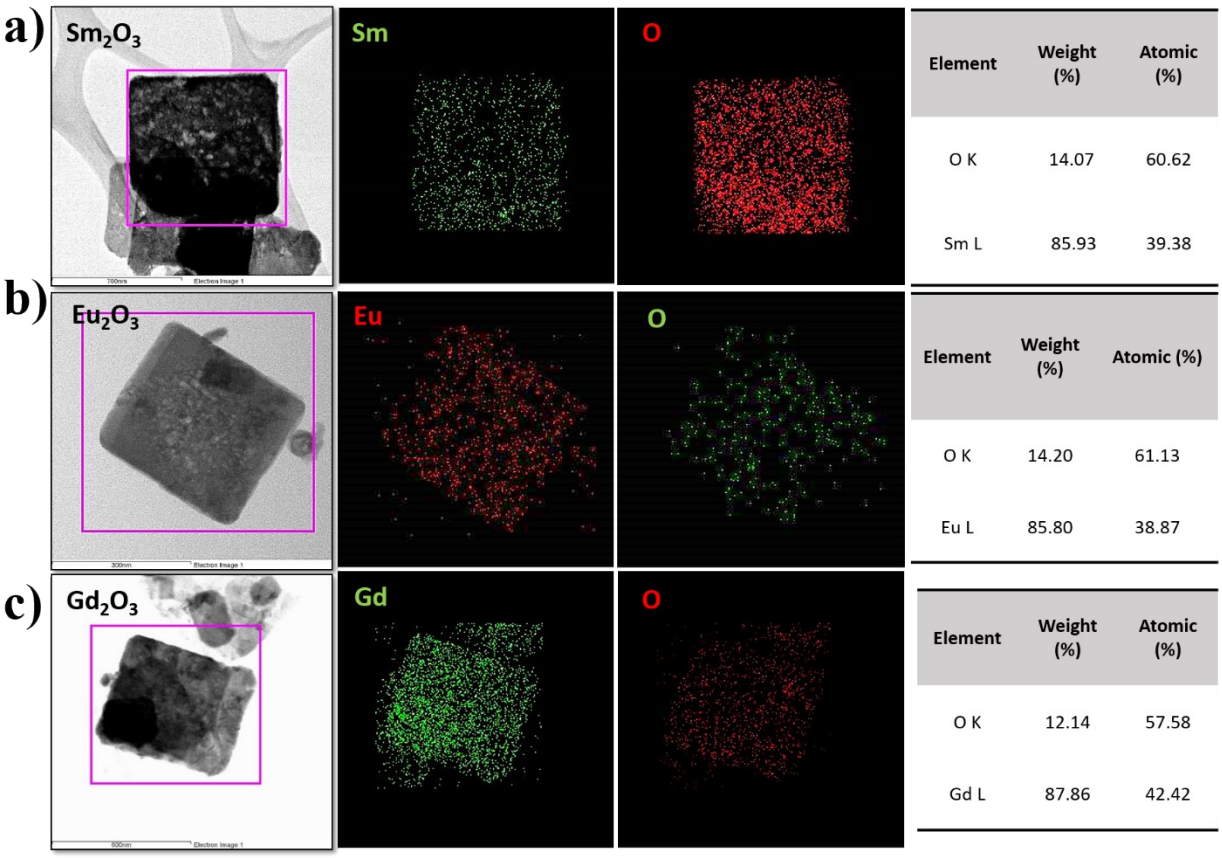


Figure S2. Average thickness of Sm_2O_3 SNPs, before and after calcination treatment at same scale bar.



Element	Weight (%)	Atomic (%)
O K	14.07	60.62
Sm L	85.93	39.38

Element	Weight (%)	Atomic (%)
O K	14.20	61.13
Eu L	85.80	38.87

Element	Weight (%)	Atomic (%)
O K	12.14	57.58
Gd L	87.86	42.42

Figure S3. TEM-EDX analysis of calcinated REO SNPs.

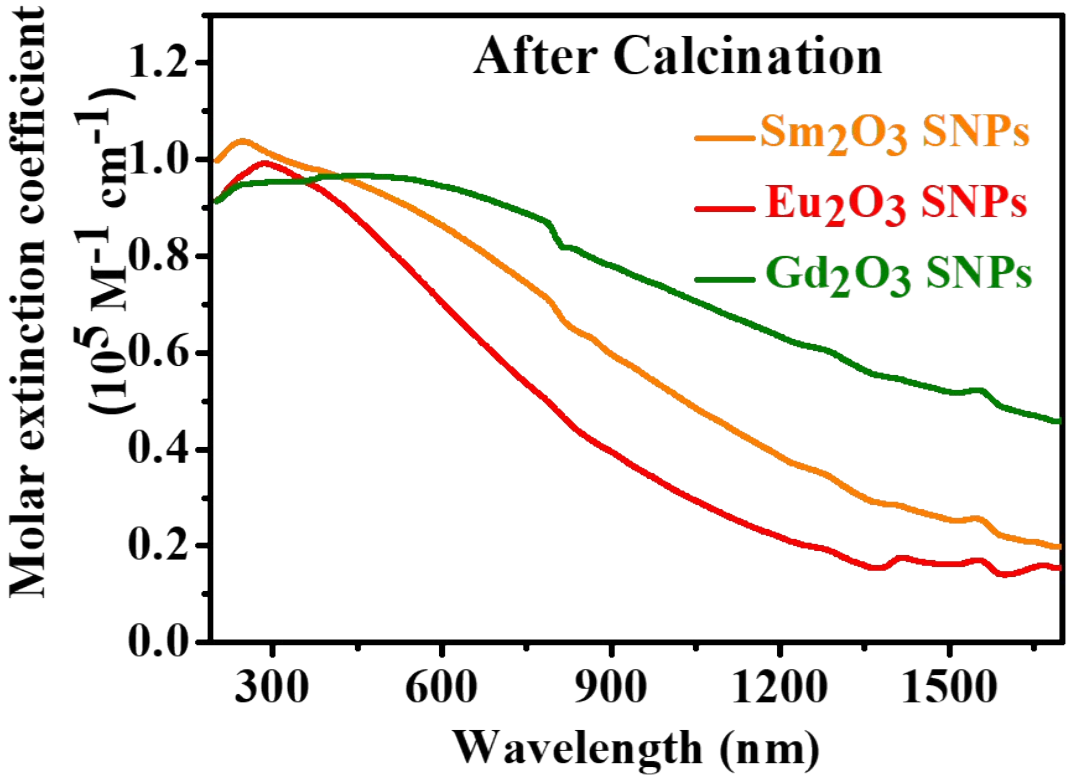


Figure S4. Molar extinction coefficient absorption spectra of REO SNP's.

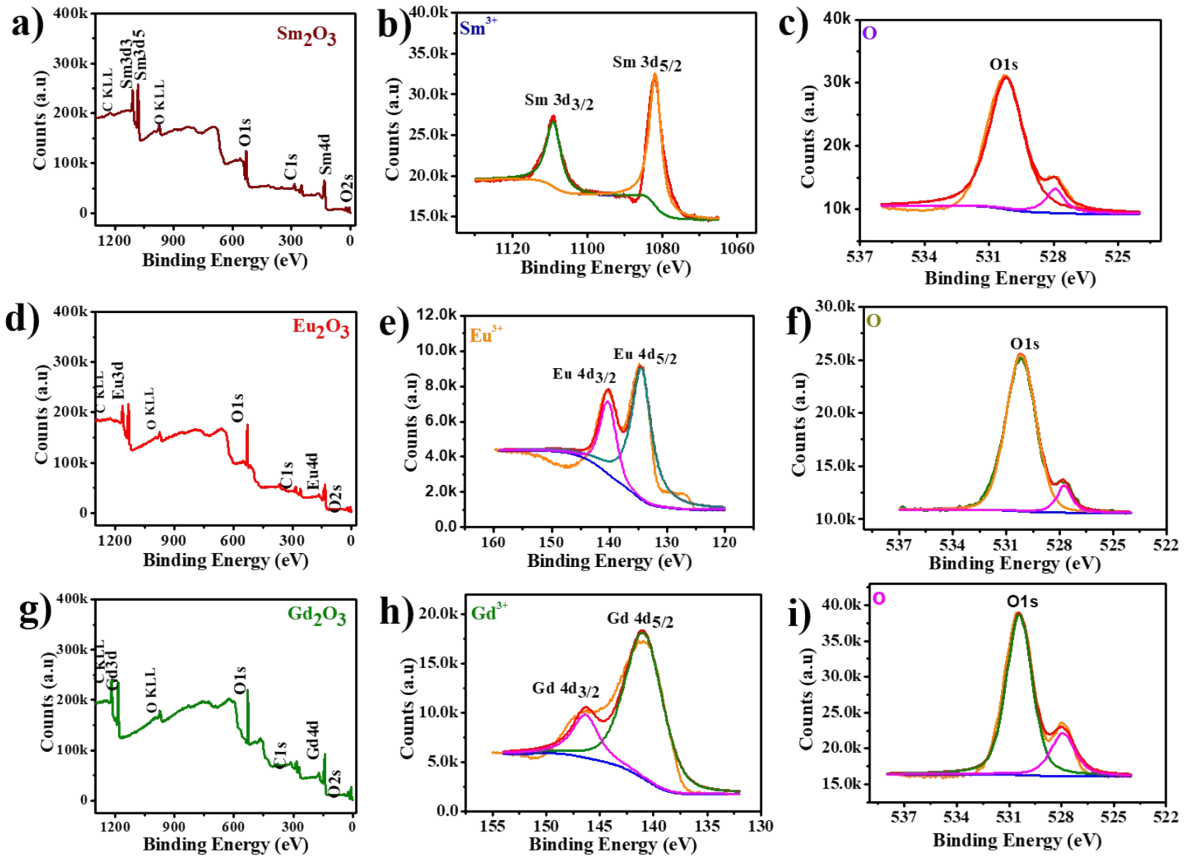


Figure S5. XPS analysis of calcinated REO SNPs. (a) survey scan Sm_2O_3 (b) high-resolution of Sm 3d, (d) Survey scan Eu_2O_3 (e) high-resolution of Eu 4d, (g) survey scan Gd_2O_3 (h) high-resolution of Gd 4d, (c, f, i) high-resolution REO square nanoplates of O 1s.

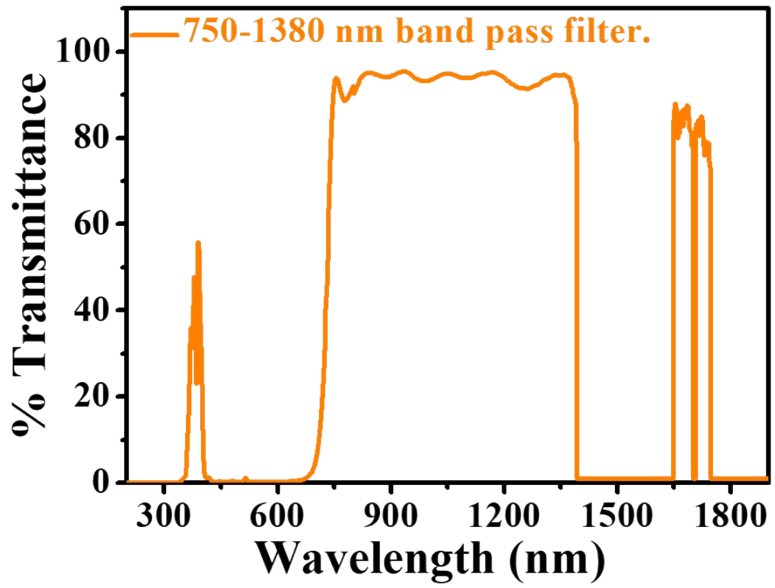


Figure S6. The transmittance spectrum of the output from a halogen lamp after a NIR long-pass filter (750-1380 nm filter).

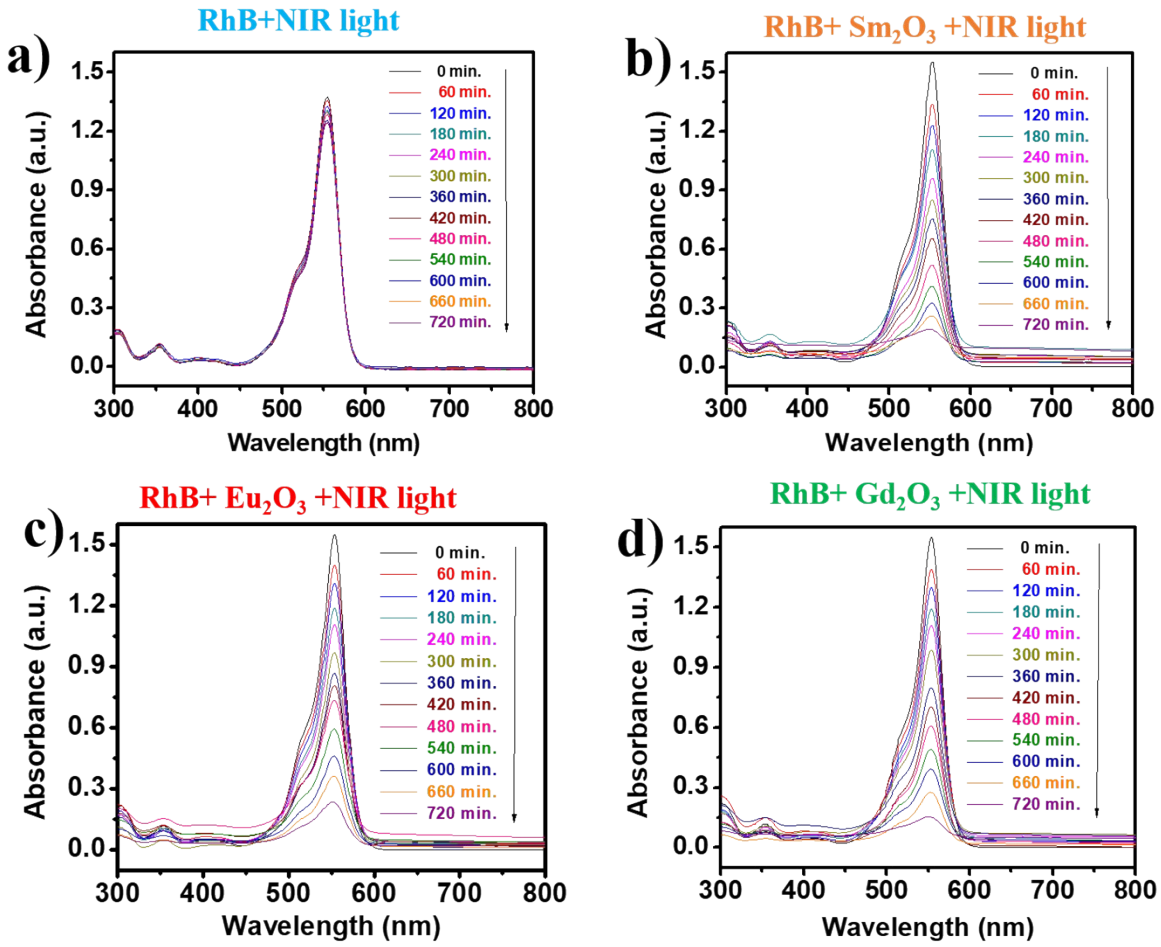


Figure S7. UV-Vis-NIR absorbance spectrum different time point absence and presence of a catalyst (a) without catalyst RhB with NIR light (b) with catalyst (without calcination) Sm_2O_3 RhB, NIR light (c) with catalyst (without calcination) Eu_2O_3 RhB, NIR light (d) with catalyst (without calcination) Gd_2O_3 RhB, NIR light.

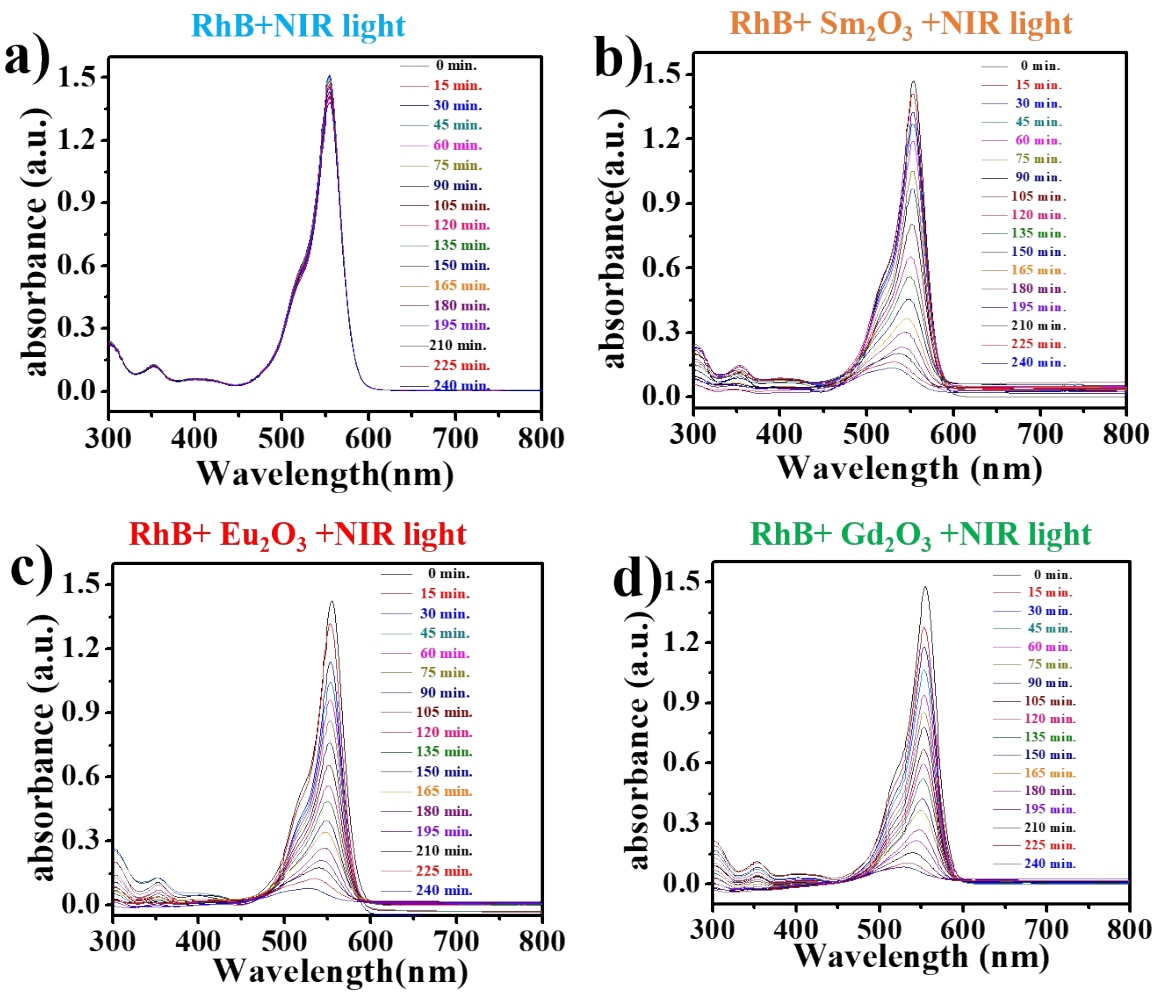


Figure S8. UV-Vis-NIR absorbance spectrum absence and presence of a catalyst at a different time point (0 -240 min.) (a) Without catalyst RhB with NIR light (b) with calcination catalyst Sm_2O_3 RhB, NIR light (c) with calcination catalyst Eu_2O_3 RhB, NIR light (d) with calcination catalyst Gd_2O_3 RhB, NIR light.

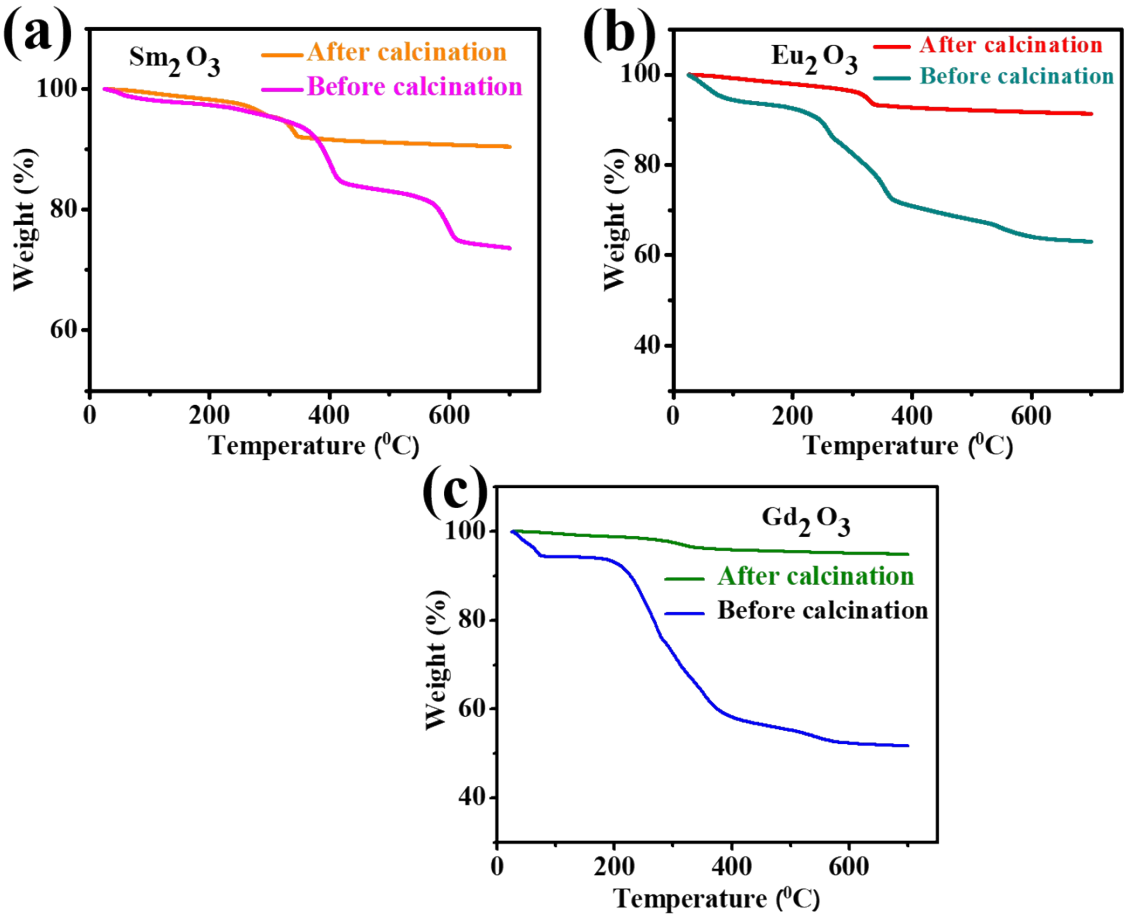


Figure S9. Thermogravimetric analysis of as synthesized SNPs a) Sm_2O_3. b) Eu_2O_3, c) Gd_2O_3. (Condition: room temperature to 750 °C with a heating rate of 10 °C/min).

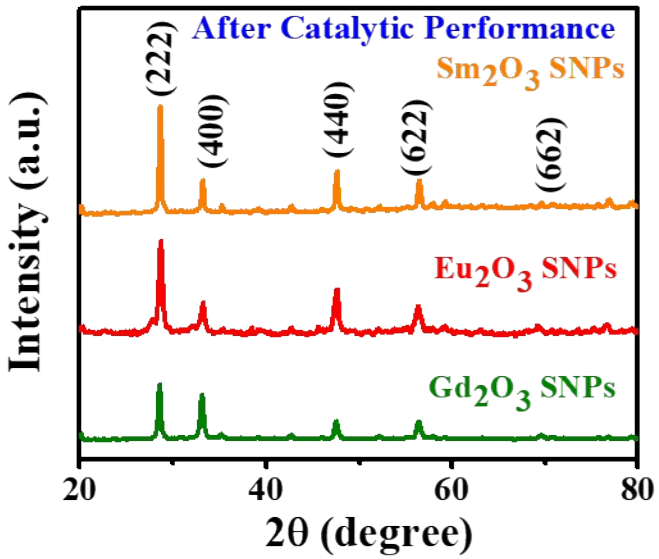


Figure S10. XRD analysis of REO SNPs after photocatalytic reaction.

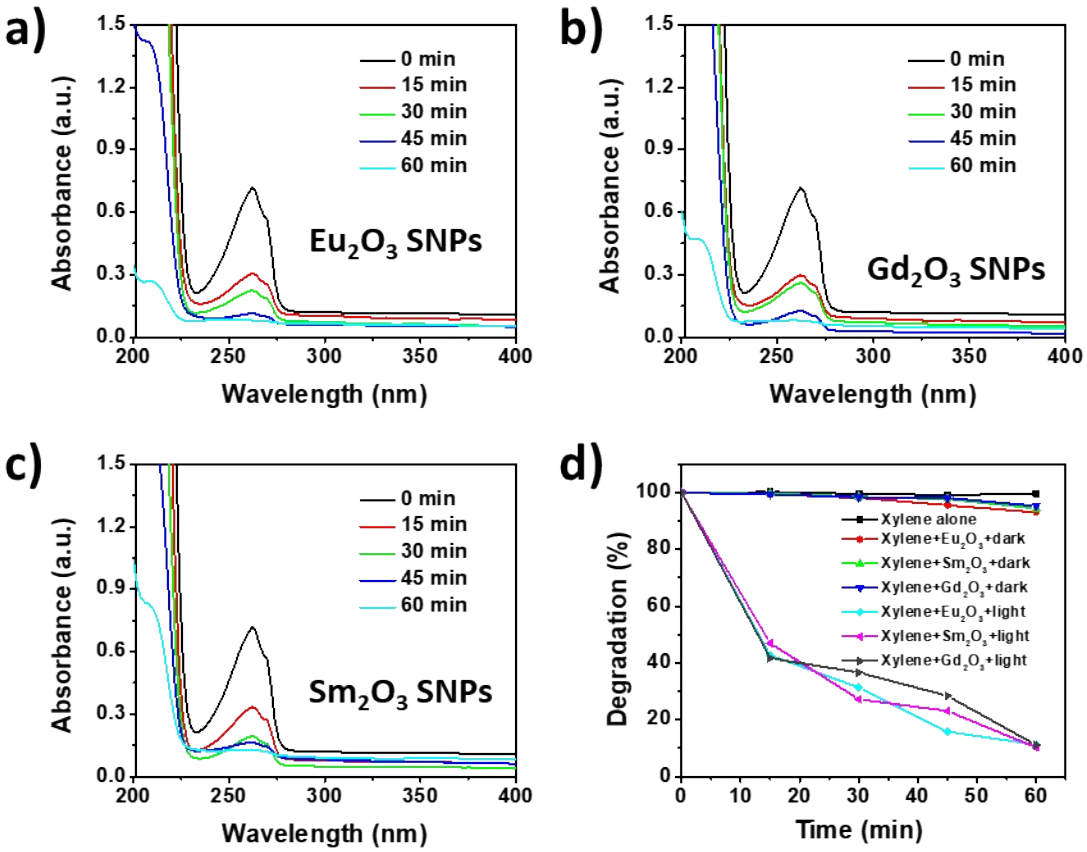


Figure S11. Photocatalytic degradation of o-xylene on REO SNPs (experimental condition: 1 mg/mL catalyst, 50 W halogen lamp fitted with a NIR filter)

Table S1 Summary of recent developments on NIR light photocatalysis.

Photocatalysis	**Organic pollutant dye**	**Irra. time(hrs)**	**Laser**	**Efficiency**	**Reference**
$BiWO_6$ nanosheets	Methyl orange	2	980 nm	75 %	**S1**
$Cu(OH)PO_4$ microcrystals	2,4-dichlorophenol	6	λ>800 nm	90 %	**S2**
$NaYF_4$:Yb, Tm@TiO_2 core-shell NPs	Methyl blue	14	980 nm	65 %	**S3**
$BiVO_4/CaF_2:Er^{3+}$, Tm^{3+}, Yb^{3+} NPs.	Methyl orange	6	980 nm	40 %	**S4**
Ag_2S/Ag_3PO_4 core/shell	Methyl orange	2	760 nm	90 %	**S5**
YF_3:Yb,Tm/TiO_2	Methyl blue	30	980 nm	70%	**S6**
CaF_2:Yb@$BiVO_4$	Methyl orange	7	980 nm	70%	**S7**
MoO_3 nanobelts	Rhodamine B	2	800–1600 nm	70 %	**S8**
β-NaYF4:Yb/Er-N-TiO2	Rhodamine B	36	980 nm	80%	**S9**
Rare Earth Oxides Sm_2O_3, Eu_2O_3, and Gd_2O_3 square nanoplates	Rhodamine B	6	750–1350 nm	**92 %** **95 %** **96 %**	**Present work**

Supplementary References

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