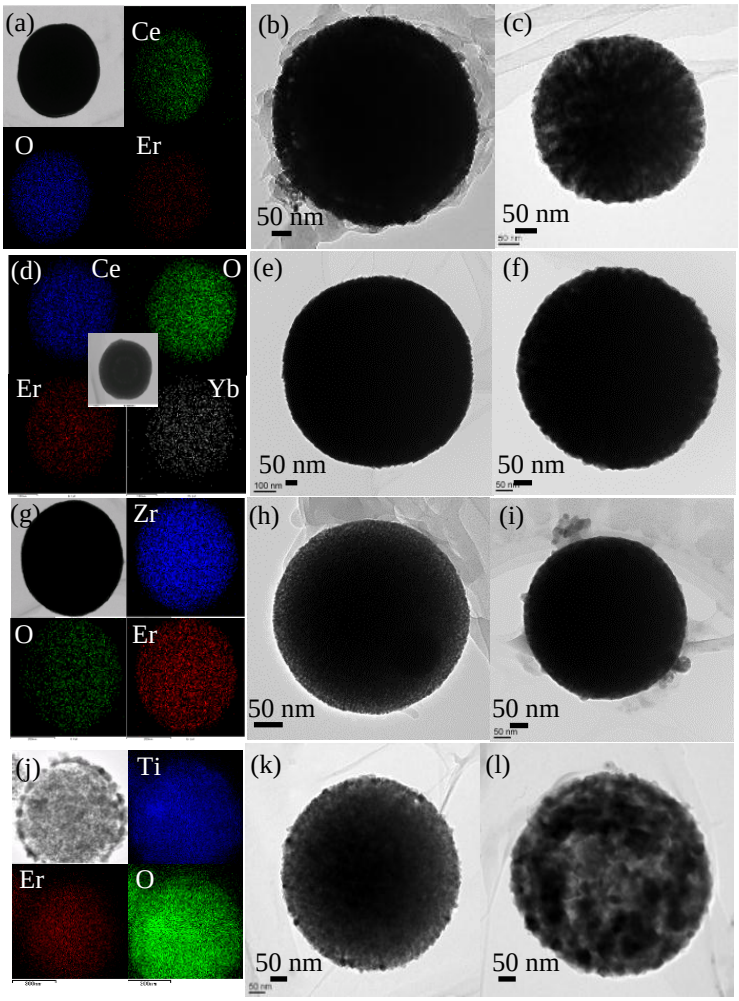



**Fig. 1.** TEM and EDX mapping images of RE doped MARIMO NPs. (a) $CeO_2$:Er (10:1) before calcination; (b) $CeO_2$:Er (100:1) before calcination; (c) $CeO_2$:Er (100:1) after calcination; (d) $CeO_2$:Er,Yb (10:1:1) before calcination; (e) $CeO_2$:Er,Yb (100:1:1) before calcination, (f) $CeO_2$:Er,Yb (100:1:1) after calcination; (g) $ZrO_2$:Er (10:1) before calcination; (h) $ZrO_2$:Er (200:1) before calcination; (i) $ZrO_2$:Er (200:1) after calcination; (j) $TiO_2$:Er (10:1) before calcination; (k) $TiO_2$:Er (200:1) before calcination; (l) $TiO_2$:Er (200:1) after calcination.

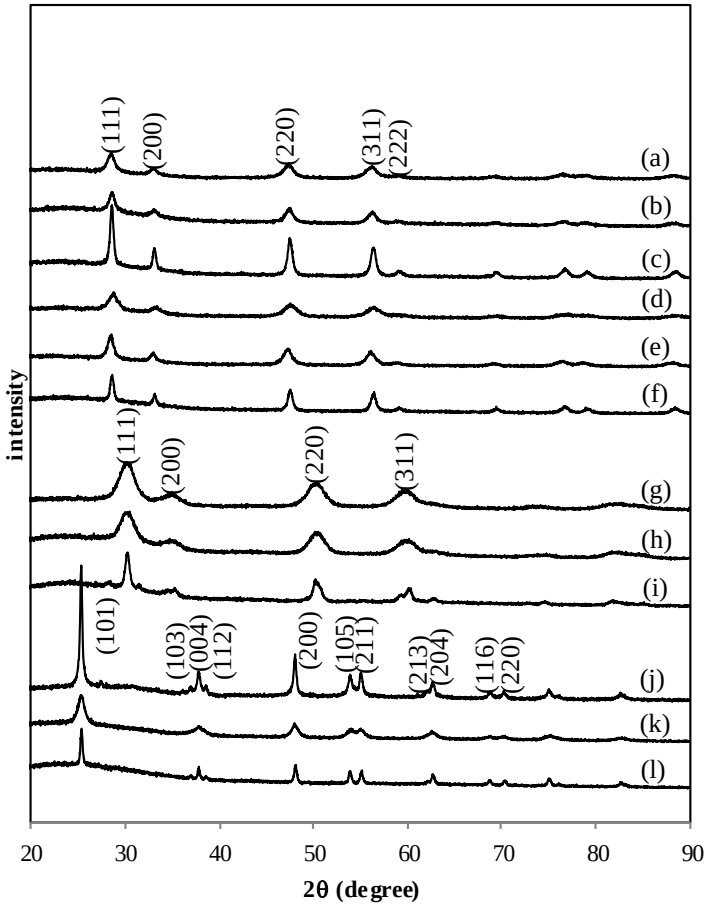



**Fig. 2.** XRD patterns of the RE doped MARIMO NPs. (a) $CeO_2$:Er (10:1) before calcination; (b) $CeO_2$:Er (100:1) before calcination; (c) $CeO_2$:Er (100:1) after calcination; (d) $CeO_2$:Er,Yb (10:1:1) before calcination; (e) $CeO_2$:Er,Yb (100:1:1) before calcination; (f) $CeO_2$:Er,Yb (100:1:1) after calcination; (g) $ZrO_2$:Er (10:1) before calcination; (h) $ZrO_2$:Er (200:1) before calcination; (i) $ZrO_2$:Er (200:1) after calcination; (j) $TiO_2$:Er (10:1) before calcination; (k) $TiO_2$:Er (200:1) before calcination; (l) $TiO_2$:Er (200:1) after calcination.

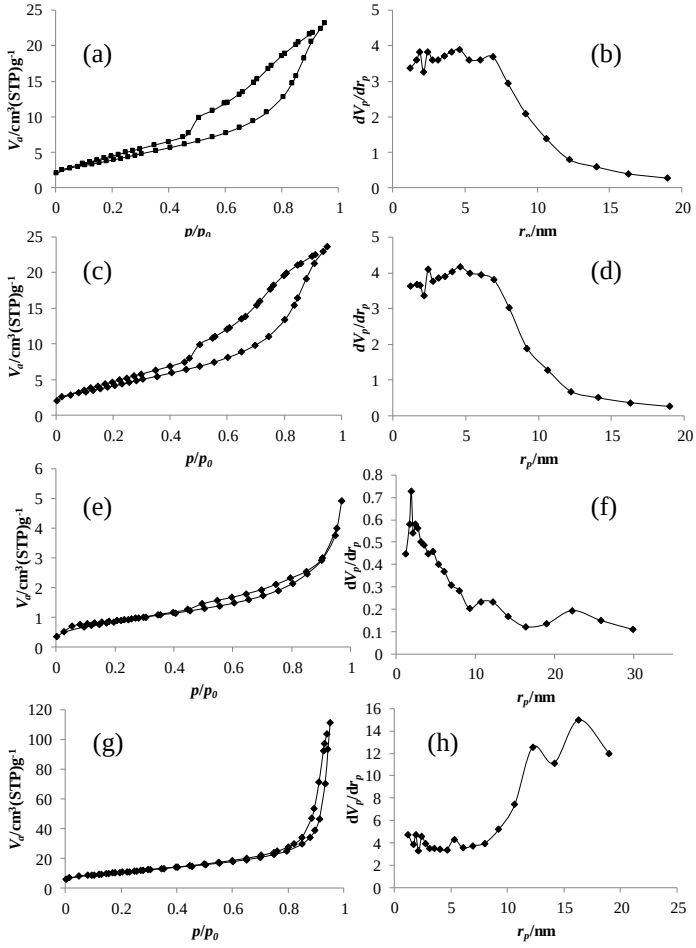



**Fig. 3.** Nitrogen adsorption–desorption isotherm and BJH pore size distribution plots of MARIMO RE doped UCNPs prepared in scMeOH after calcination at 800 ℃ for 60 min. (a and b) $CeO_2$:Er (100:1); (c and d) $CeO_2$:Er,Yb (100:1:1); (e and f) $ZrO_2$:Er (200:1); (g and h) $TiO_2$:Er (200:1).

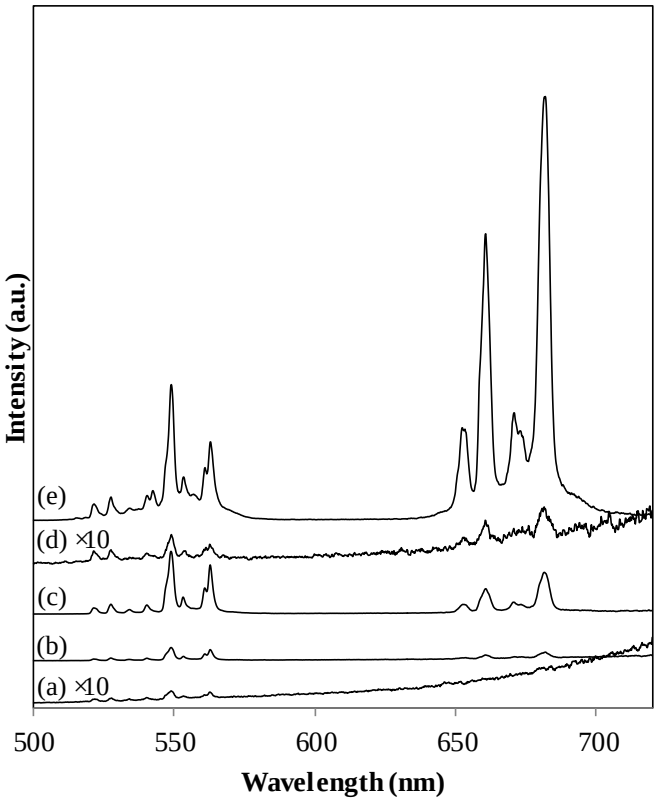



**Fig. 4.** Photoluminescence spectra (under IR irradiation at 980 nm) of $CeO_2$:Er and $CeO_2$:Er,Yb MARIMO prepared from a mixture of scMeOH and formic acid. Reaction conditions were 10 min at 300 °C in 0.28 g $mL^{-1}$ MeOH density. (a) $CeO_2$:Er (100:1) without calcination; (b) $CeO_2$:Er (100:1) with calcination at 500 °C for 1 h; (c) $CeO_2$:Er (100:1) with calcination at 800 °C for 1 h; (d) $CeO_2$:Er,Yb (100:1:1) without calcination; (e) $CeO_2$:Er,Yb (100:1:1) with calcination at 800 °C for 1 h.

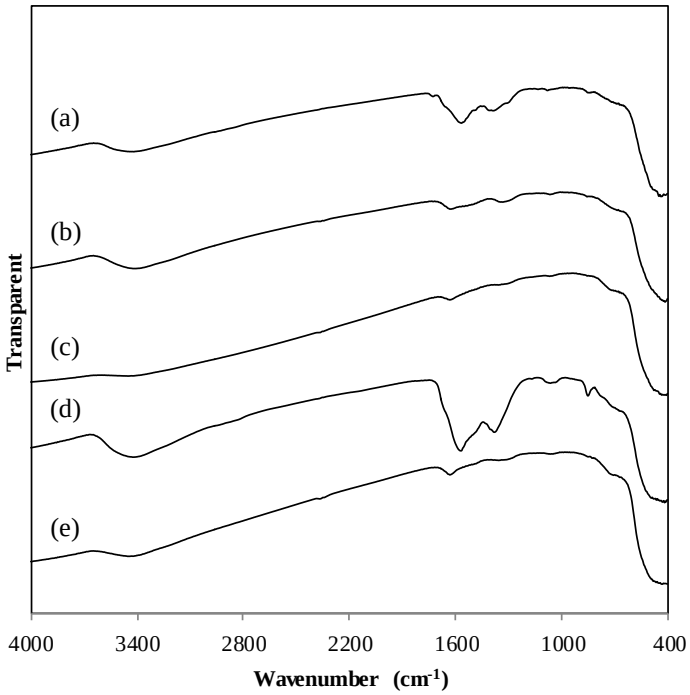



**Fig. 5.** FTIR spectra of $CeO_2$:Er (100:1) and $CeO_2$:Er,Yb (100:1:1) MARIMO NPs prepared in scMeOH in the presence of HCOOH. Reaction conditions were 10 min at 300 °C in 0.28 g $mL^{-1}$ MeOH density. (a) $CeO_2$:Er (100:1) without calcination; (b) $CeO_2$:Er (100:1) with calcination at 500 °C for 60 min in air; (c) $CeO_2$:Er (100:1) with calcination at 800 °C for 60 min in air; (d) $CeO_2$:Er,Yb (100:1:1) without calcination; (e) $CeO_2$:Er,Yb (100:1:1) with calcination at 800 °C for 60 min in air.

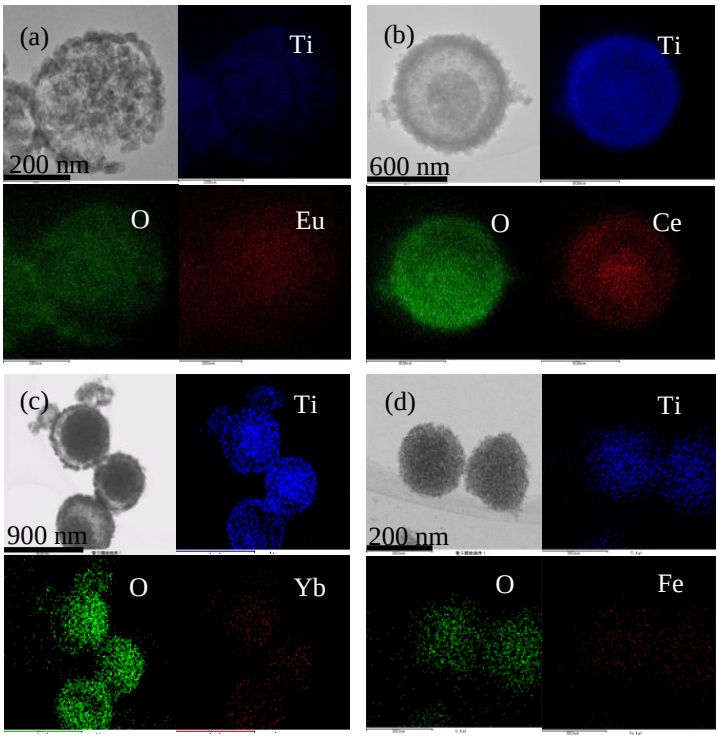
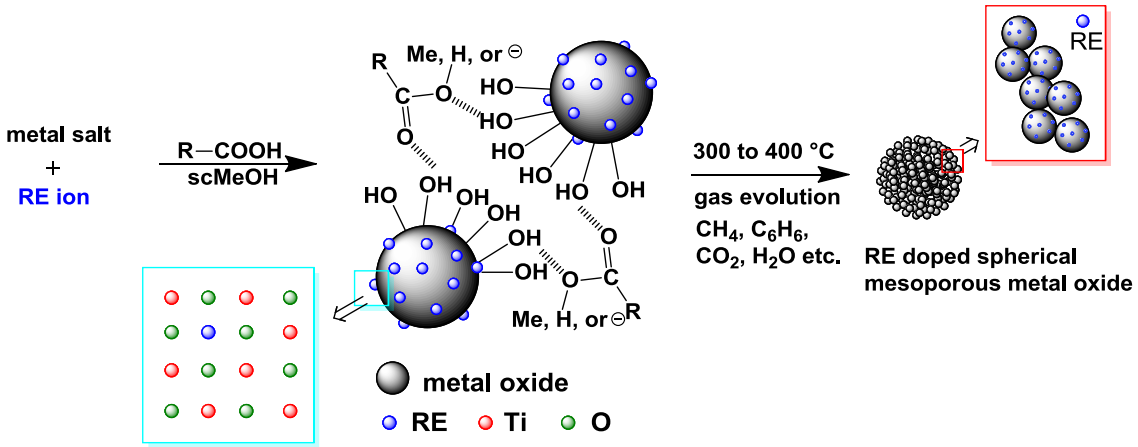



**Fig. 6.** EDX mapping of (a) $TiO_2$:Eu (10:1), (b) $TiO_2$:Ce (10:1), and (c) $TiO_2$:Yb (10:1) MARIMO NPs prepared at 400 °C in 10 min and 0.28 g $mL^{-1}$ MeOH density in the presence of acetic acid and (d) $TiO_2$:Fe (10:1) MARIMO NPs prepared at 300 °C in 10 min and 0.28 g $mL^{-1}$ MeOH density in the presence of phthalic acid.




**Scheme 1.** Mechanism for the formation of RE doped spherical mesoporous metal oxide nanoparticles in supercritical methanol.