

# The role of 2-Ethylhexanoic acid in manipulating the morphology and upconversion of the flame-made $\text{Y}_2\text{O}_3:\text{Yb}^{3+}/\text{Ho}^{3+}$ nanoparticles toward remote temperature sensing

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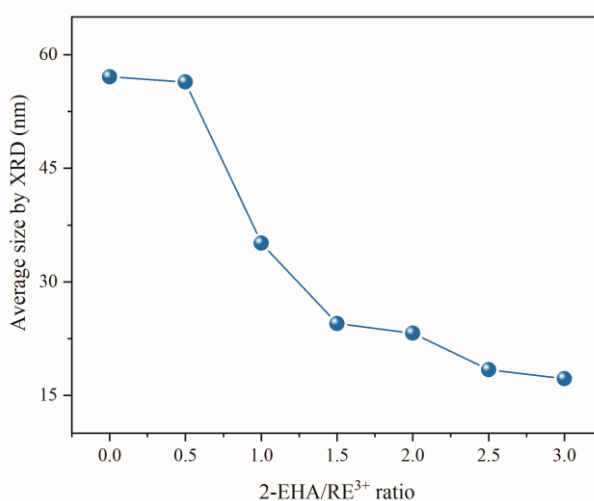
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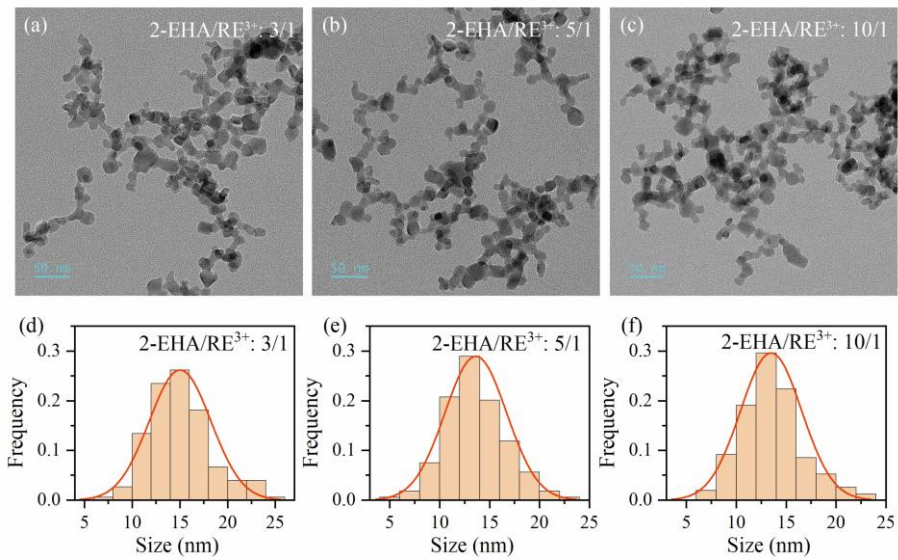
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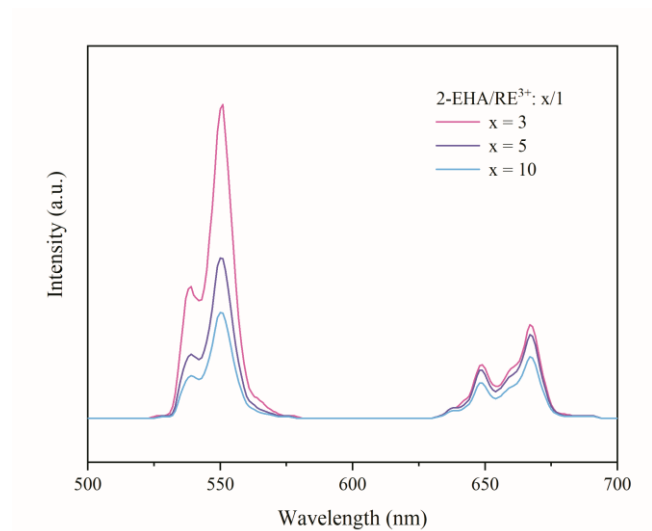
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**Fig.S1** Average size of  $\text{Y}_2\text{O}_3:\text{Yb}^{3+}$ (8 mol%)/ $\text{Ho}^{3+}$ (1 mol%) UCNPs with different 2-EHA/ $\text{RE}^{3+}$  molar ratios ( $x/1$ ,  $x = 0, 0.5, 1, 1.5, 2, 2.5, 3$ ) calculated by XRD.



**Fig.S2** TEM images of  $\text{Y}_2\text{O}_3:\text{Yb}^{3+}(8 \text{ mol}\%)/\text{Ho}^{3+}(1 \text{ mol}\%)$  UCNP with 2-EHA/ $\text{RE}^{3+}$  molar ratios:  $x/1$ , (a)  $x = 3$ ; (b)  $x = 5$ ; (c)  $x = 10$ . The corresponding particle size distribution based on TEM images (a) (b) and (c) recorded as (d), (e) and (f), respectively.



**Fig.S3** UCL spectra of  $\text{Y}_2\text{O}_3:\text{Yb}^{3+}(8 \text{ mol}\%)/\text{Ho}^{3+}(1 \text{ mol}\%)$  UCNP with 2-EHA/ $\text{RE}^{3+}$  molar ratio ( $x/1$ ,  $x = 3, 5, 10$ ) under the excitation of 976 nm laser with the power density of  $159.09 \text{ W cm}^{-2}$ ;