Figure S1. Particle size distribution histograms of $\text{REF}_3$ ($\text{RE} = \text{La, Pr, Nd}$), $\text{NaREF}_4$ ($\text{RE} = \text{Sm–Ho, Y}$), and $\text{Na}_5\text{RE}_9\text{F}_{32}$ ($\text{RE} = \text{Er, Yb, Lu}$) NCs.
Figure S2. FT-IR spectrum of representative NaGdF₄ NCs.

The oleic acid (OA) ligand plays an important role in the formation of monodisperse NCs, which provides the as-prepared NCs with excellent stability and solubility in non-polar solution. The presence of the OA ligand can be confirmed by the FT-IR spectrum of NaGdF₄ NCs (Figure S2). As shown, the absorption peaks at 2919 cm⁻¹ and 2851 cm⁻¹ can be assigned to the symmetric (νₛ) stretching vibrations of –CH₃ group and –CH₂ groups, respectively. The peak at 1706 cm⁻¹ is associated with the C=O stretching vibration. The peaks at 1559 and 1467 cm⁻¹ can be ascribed to the asymmetric (νₐs) and symmetric (νₛ) stretching vibration of the carboxylic group (–COOH), respectively. The peak at 723 cm⁻¹ is assigned to the in-planar swing of (CH₂)ₙ (n > 4). Thus, it can be concluded that the as-prepared NaGdF₄ NCs have been capped by OA molecules, which endow the NCs with hydrophobic surfaces and lead to good dispersibility in non-polar cyclohexane solvent.
Figure S3. NIR-to-visible UC emission spectra of LaF₃:Yb/Er (A), LaF₃:Yb/Tm (B), and LaF₃:Yb/Ho NCs (C).
Figure S4. CIE chromaticity diagram of NaGdF$_4$:Yb/Er (a), NaGdF$_4$:Yb/Tm (b), NaGdF$_4$:Yb/Ho (c), Na$_5$Lu$_9$F$_{32}$:Yb/Er (d), Na$_5$Lu$_9$F$_{32}$:Yb/Ho NCs (e), and Na$_5$Lu$_9$F$_{32}$:Yb/Tm (f).

References:

