Electronic Supplementary Information

Optically active multi-helical erythrocyte-like $Ln(OH)CO_3$ (Ln= La, Ce, Pr and Sm)

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Experimental section

Materials

Lanthanide nitrate hexahydrate (Ln= La, Ce, Pr and Sm), L-Aspartic acid sodium (L-AspNa), sodium carbonate (Na2CO3) and sodium hydroxide (NaOH) were purchased and used as received.

Preparation of RBCs $LnCO_3OH$

The preparation process was based on our previous report.[1] Typically, 1.5 mmol Na_2CO_3 was dissolved in 10 ml deionized water, then 10ml mixture solution (6 mmol L-AspNa and 2 mmol $Ln(NO_3)_3 \bullet 6H_2O$(Ln= La, Ce, Pr and Sm)) was dropped into the above solution and stirred vigorously for 1 h. After that, 6 ml 1M NaOH was added to the above mixture dropwise. After stirring for another 3h, the resulting suspension was transferred into a 30 mL autoclave and treated at 160 ^oC for 48 h. The as-prepared products were washed with deionized water and ethanol successively and stay overnight at 60 ^oC in air.

Characterization

The crystallographic phases of the as-synthesized simples were performed on a Rikagu D/max 2200PC， with Cu Kα radiation (λ =1.5406 Å). The morphology of the as-prepared simples was characterized by FE-SEM (FEI SIRION) and transmission electron microscopy (JEOL 2010 FEG). To obtain a cross section of the RBCs-LnCs, a thin-section with the thickness of 70 nm were prepared on a Leica EM UC6 Ultramicrotome with a diamond knife. Diffuse reflectance ultraviolet visible (DRUV) spectra was recorded by a Shimadzu UV-3600 spectropolarimeter at room temperature. DRCD spectra were recorded by a JASCO J-815 spectropolarimeter at room temperature. The photoluminescence measurements were carried out on an F-4500 spectrofluorometer (Hitachi Japan) at room temperature.

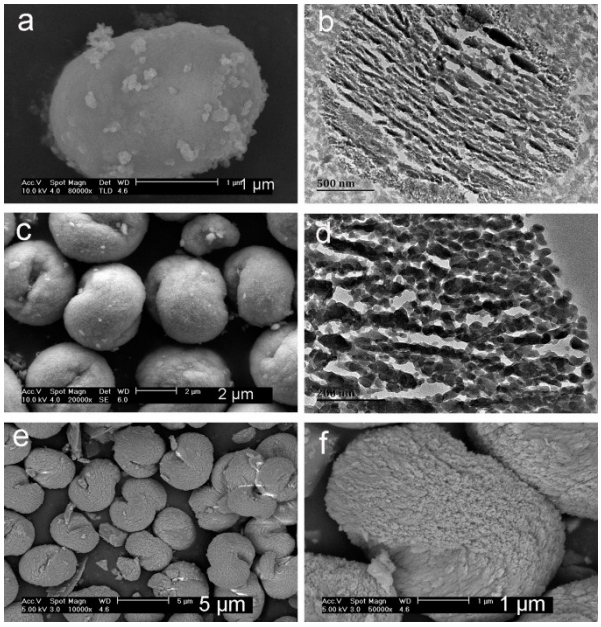

Figure S1. SEM images (a) and TEM images (b) of RBCs-LnCs, SEM images (c) and TEM images (d) of RBCs-PrCs, SEM images (e, f) of RBCs-SmCs.

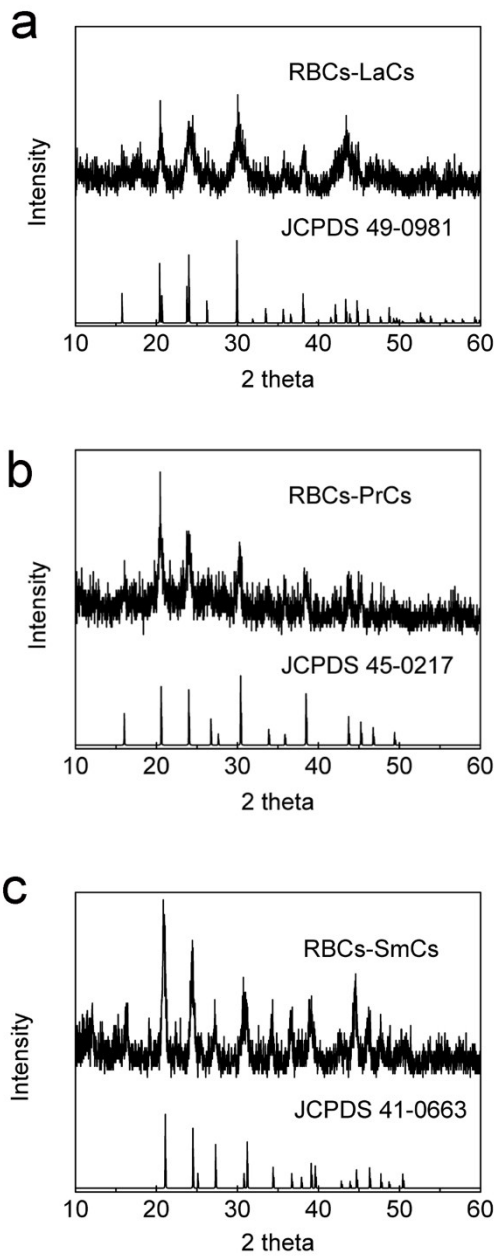

Figure S2. XRD patterns of (a) RBCs-LaCs, (b) RBCs-PrCs and (c) RBCs-SmCs.

Table S1. Assignments of peaks in the DRUV-vis spectra of RBCs-LnCs (Ln= La, Pr and Sm).

sample	Wavelength/nm	Transition
RBCs-LaCs	214	$O^{2-} \rightarrow La^{3+},^{2}$
RBCs-PrCs	217	$O^{2-} \rightarrow Pr^{3+},^{2}$
	446	$^{3}H_4 \rightarrow {}^{3}P_2{}^{3}$
	472	$^{3}H_4 \rightarrow {}^{3}P_1, {}^{1}I_6{}^{3}$
	488	$^{3}H_4 \rightarrow {}^{3}P_0{}^{3}$
	590	$^{3}H_4 \rightarrow {}^{1}D_2{}^{3}$
RBCs-SmCs	210	$O^{2-} \rightarrow Sm^{3+},^{2}$
	404	$^{6}H_{5/2} \rightarrow {}^{6}P_{3/2}{}^{4}$
	472	$^{6}H_{5/2} \rightarrow {}^{4}G_{7/2}{}^{4}$

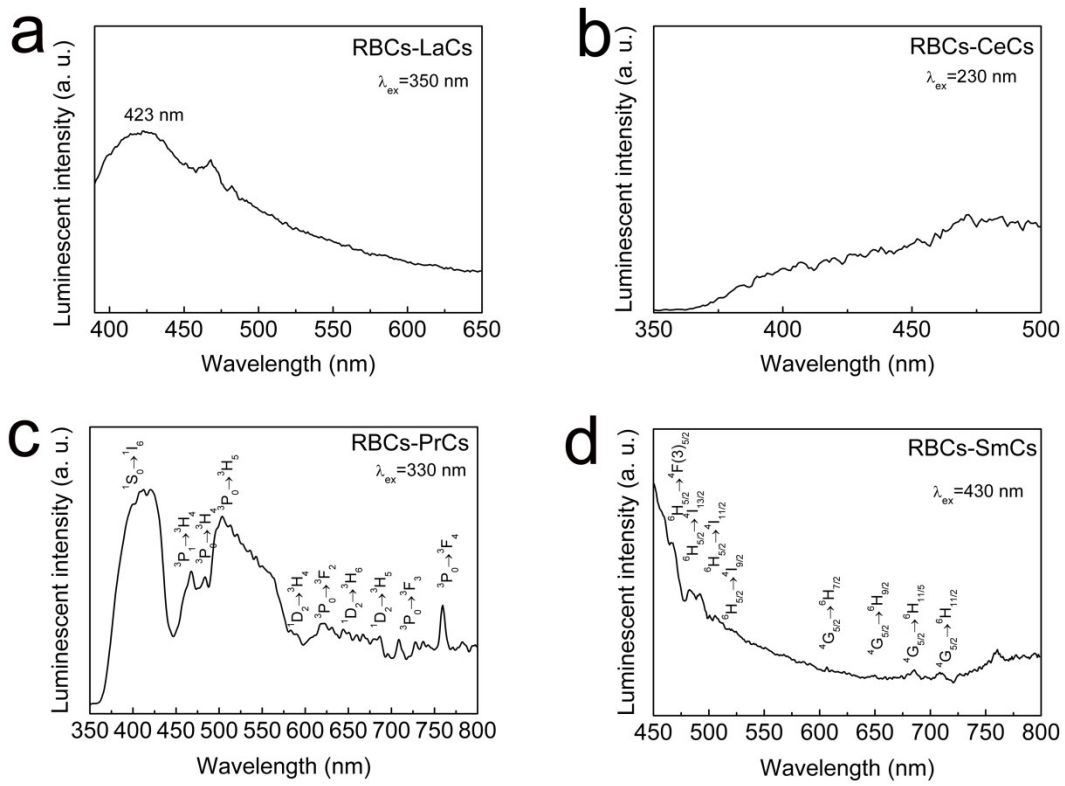

Figure S3. Emission spectra of RBCs-LnCs (Ln= La, Ce, Pr and Sm).

Table S2. Assignment of the transitions in the emission spectra of RBCs-LnCs (Ln= Pr and Sm).

sample	Wavelength/nm	Transition
RBCs-PrCs	407.6	$^1S_0 \rightarrow {}^1I_6$,[5, 6]
	468.6	$^3P_1 \rightarrow {}^3H_4$,[5, 6]
	486.6	$^3P_0 \rightarrow {}^3H_4$,[7]
	504.6	$^3P_0 \rightarrow {}^3H_5$,[7]
	586.6	$^1D_2 \rightarrow {}^3H_4$,[7]
	622.6	$^3P_0 \rightarrow {}^3F_2$,[8]
	644.6	$^1D_2 \rightarrow {}^3H_6$,[9]
	684.6	$^1D_2 \rightarrow {}^3H_5$,[7]
	708.6	$^3P_0 \rightarrow {}^3F_3$,[7]
	759.6	$^3P_0 \rightarrow {}^3F_4$,[8]
RBCs-SmCs	467.6	$^6H_{5/2} \rightarrow {}^4F(3)_{5/2}$,[10]
	482.6	$^6H_{5/2} \rightarrow {}^4I_{13/2}$,[10]
	491.6	$^6H_{5/2} \rightarrow {}^4I_{11/2}$,[11]
	505.6	$^6H_{5/2} \rightarrow {}^4I_{9/2}$,[11]
	606.6	$^4G_{5/2} \rightarrow {}^6H_{7/2}$,[12]
	649.6	$^4G_{5/2} \rightarrow {}^6H_{9/2}$,[12]
	685.6	$^4G_{5/2} \rightarrow {}^6H_{11/5}$,[7]
	708.6	$^4G_{5/2} \rightarrow {}^6H_{11/2}$,[12]
	760.6	not assignalbe

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