

Electronic Supplementary Information

A novel one-pot strategy to rapidly synthesize bright red emitting upconversion nanocrystals with core-shell-shell structure

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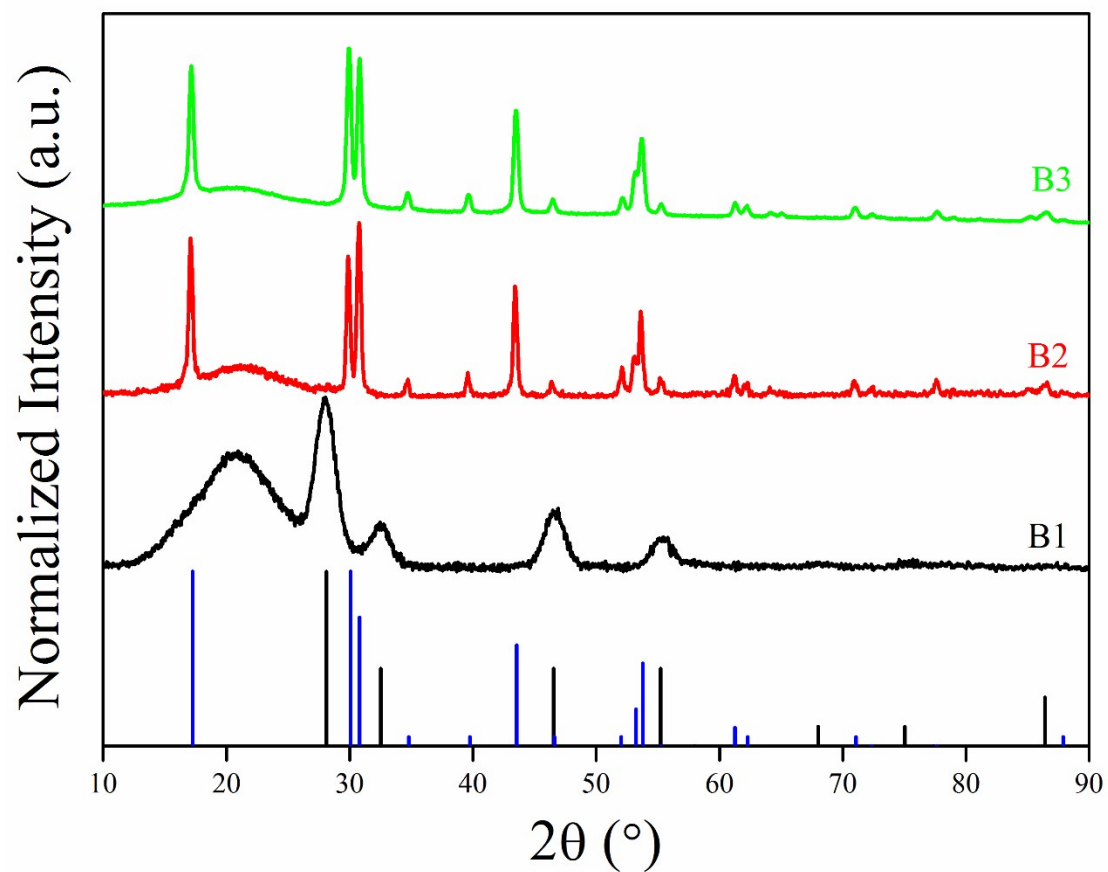


Figure S1. XRD of samples B1, B2 and B3, the reaction temperature of which were 280, 290 and 300°C, respectively. The black vertical line was the standard XRD pattern of α phase (PDF no. 27-0688) and the blue one was β phase (PDF no. 27-0689).

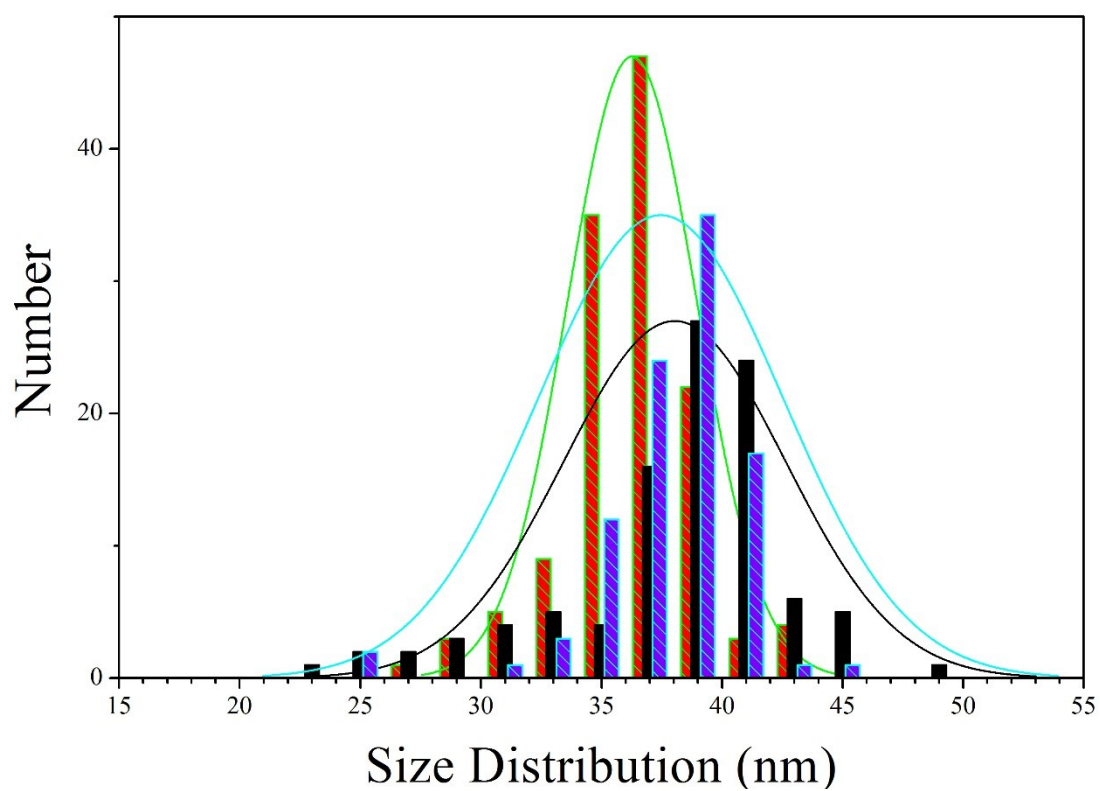


Figure S2. Size distribution of samples A3 (black), B3 (cyan) and C3 (green), the standard deviation of which equal to 6.44, 6.20 and 3.75, respectively.

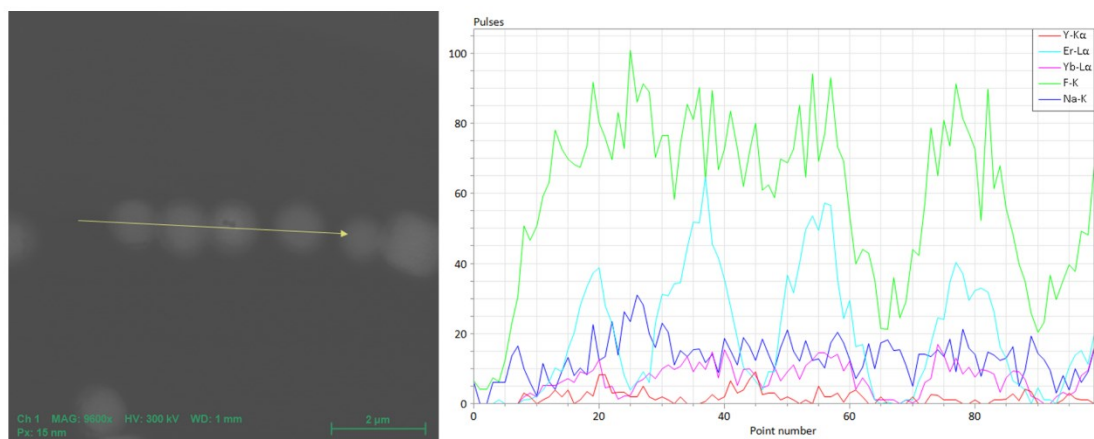


Figure S3. HAADF images of CSS and the corresponding elemental linescans.

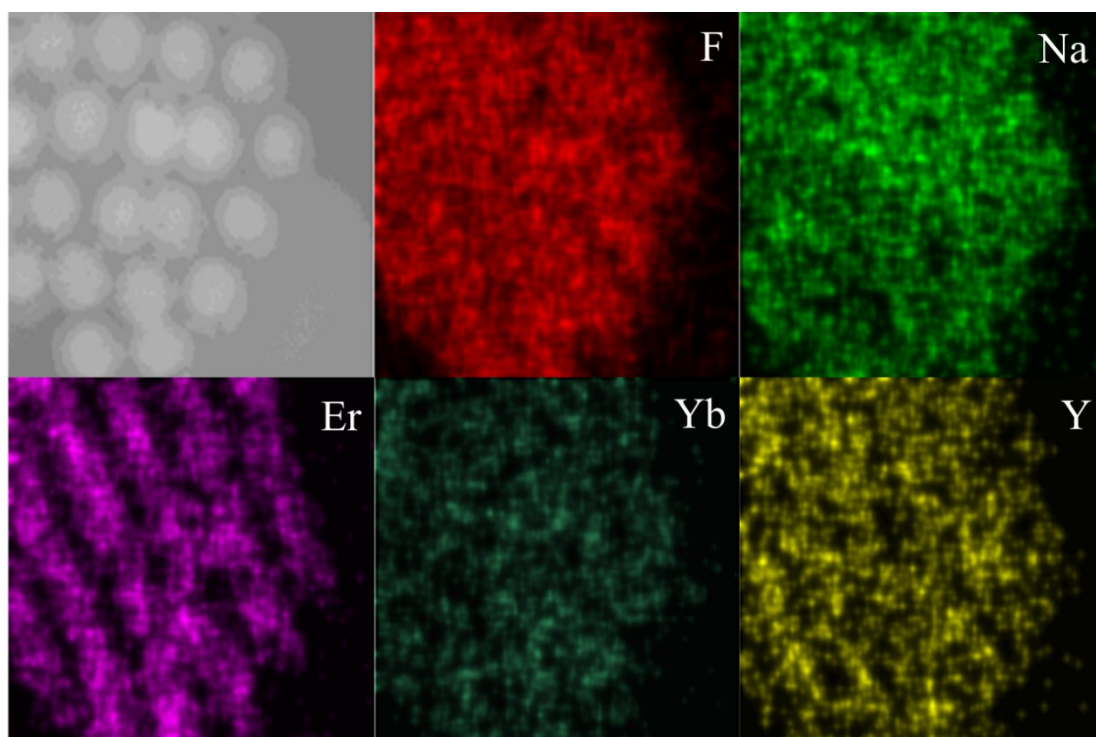


Figure S4. HAADF image of CSS and the corresponding elemental mapping images.

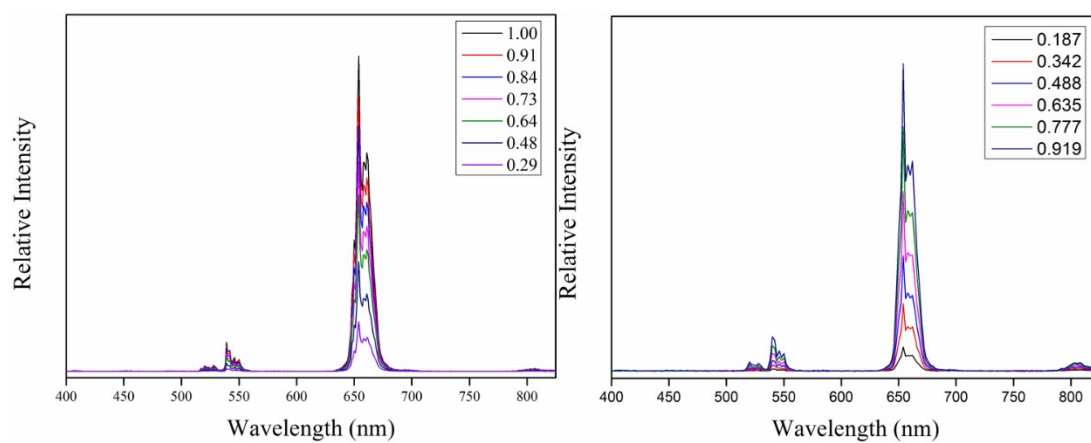


Figure S5. Upconversion luminescence spectra of sample CSS pumped by 980 nm (left) and 1532 nm (right) lasers with different powers.

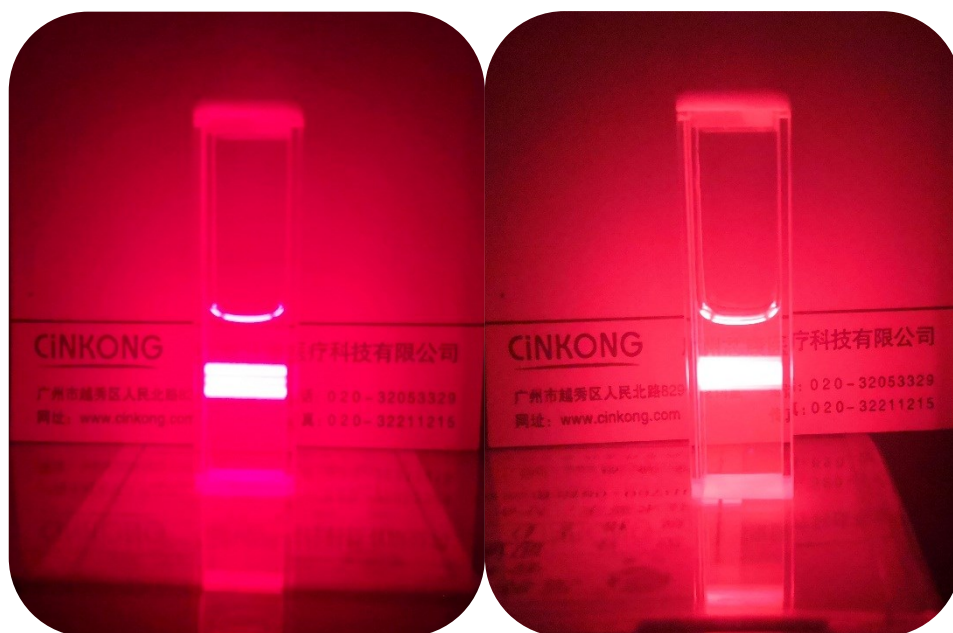


Figure S6 The photograph of sample CSS pumped by 980 nm (left) and 1532 nm lasers (right).

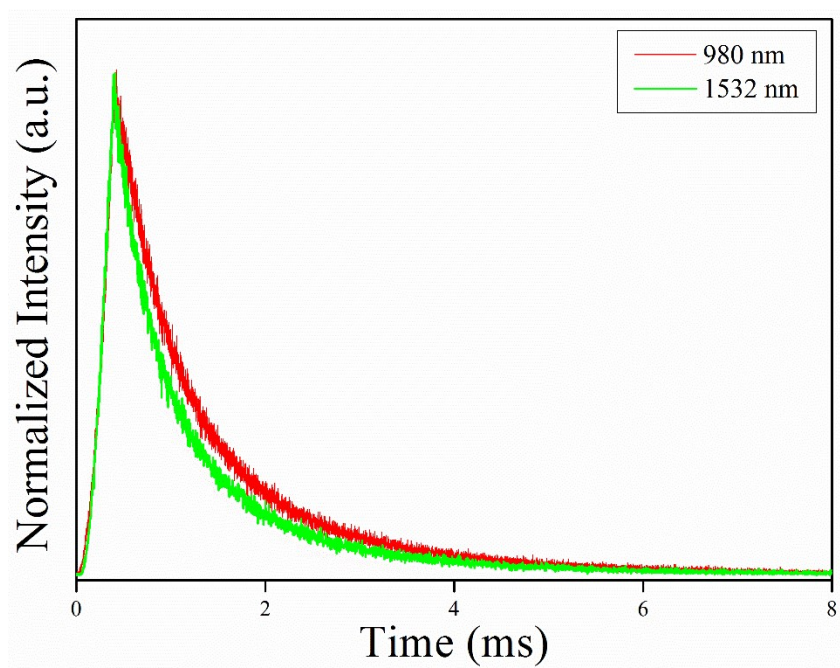


Figure S7. Lifetime decay curves of sample CSS pumped by 980 nm and 1532 nm lasers, respectively.

Table S1. The average size of several typical samples.

Samples	Average size (nm)
A3	37.8
B3	35.0
C1	~150
C2	~100
C3	38.3
Core	31.0
CIS	35.8
CAS	35.5
CSS	48.6

Table S2. The abbreviation of samples and the parameters in Figure 4.

Samples	Abbreviation	Lifetime (μ s)		Intensity (a.u.)		Enhancement Factor	
		980 nm	1532 nm	980 nm	1532 nm	980 nm	1532 nm
β -NaErF ₄ :0.005Tm	Core	16.8	41.2	262	9	—	—
β -NaErF ₄ :0.005Tm @NaYbF ₄	CAS	23.4	234.7	1296	1848	4.95	205.33
β -NaErF ₄ :0.005Tm @NaYF ₄	CIS	34.8	164.6	1506	2178	5.75	242.00
β -NaErF ₄ :0.005Tm @NaYbF ₄ @NaYF ₄	CSS	115.6	744.8	76316	156292	291.28	17365.78