

Supporting Information for

Near infrared photocatalyst of BiVO₄/CaF₂: Er³⁺, Tm³⁺, Yb³⁺ with enhanced upconversion property

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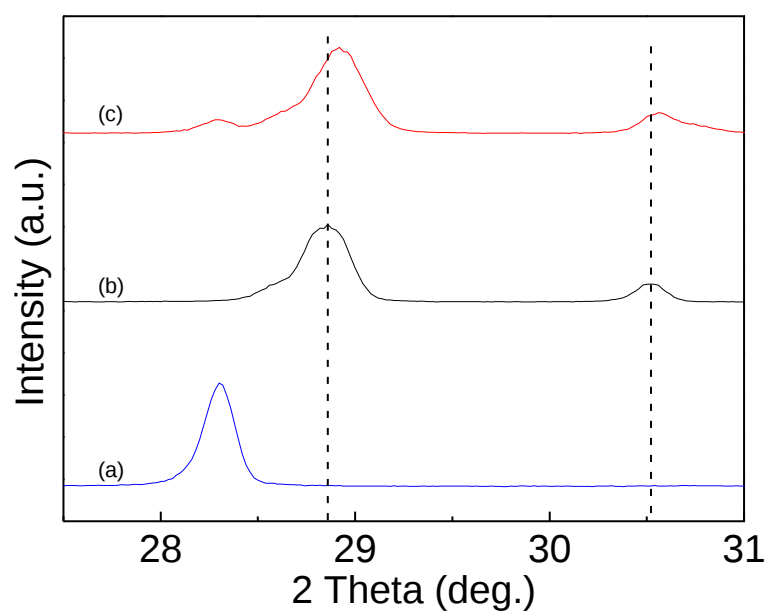


Fig. S1 Details of XRD patterns in the range of 2θ from 28° to 31° for (a) CF, (b) pure BVO, and (c) BVO/CF.

Table S1 The lattice parameters of BVO and BVO/CF

Samples	a (Å)	b (Å)	c (Å)
BVO	5.197	5.096	11.702
BVO/CF	5.194	5.090	11.697

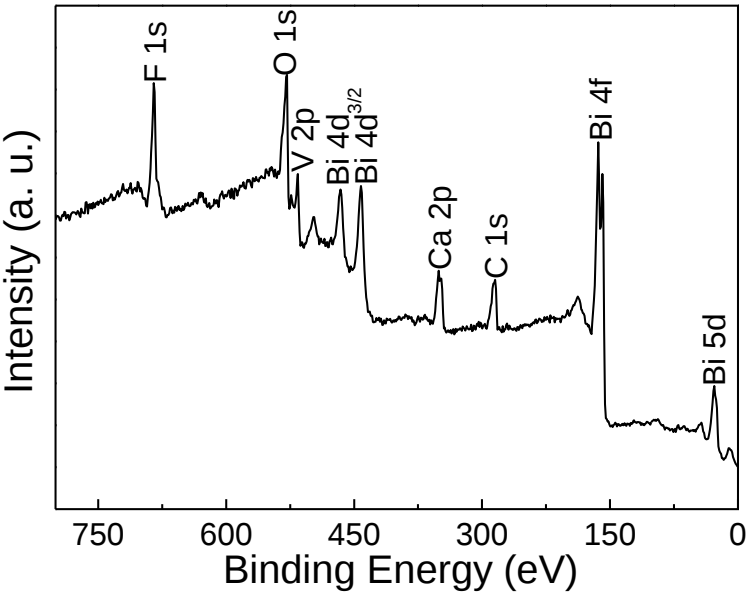


Fig. S2 Survey scan XPS spectrum of BVO/CF.

Table S2 Chemical element contents of BVO/CF obtained from XPS and EDS

Elements	BVO/CF surface	White particles	Black particles	The interfaces between the white particles and the black particles
	XPS	EDS	EDS	EDS
Bi content (atomic %)	13.70	-	19.52	7.30
Ca content(atomic %)	13.70	24.09	-	20.62
V content(atomic %)	-	-	17.96	6.08
O content(atomic %)	-	-	62.52	20.31
F content(atomic %)	-	56.85	-	38.40
Er content(atomic %)	-	1.08	-	0.49
Tm content(atomic %)	-	1.58	-	0.52
Yb content(atomic %)	-	11.39	-	6.28

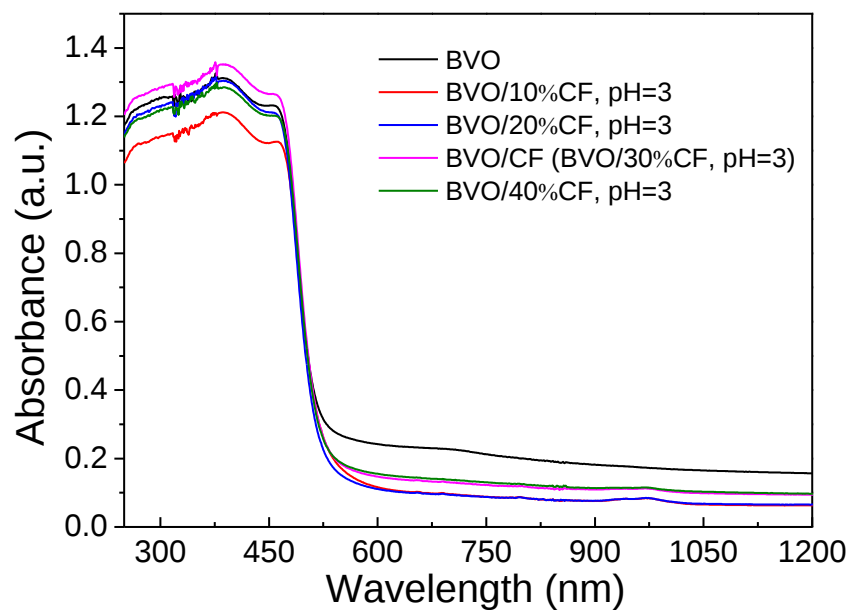


Fig. S3 UV-vis-NIR diffuse reflectance spectra for BVO and the BVO/CF composites with various CF contents: 10%, 20%, 30%, and 40% (mass fraction).

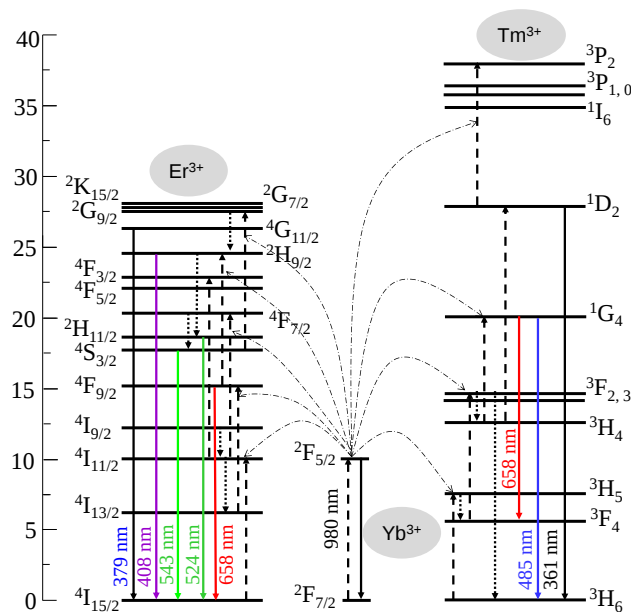


Fig. S4 Schematic illustration of the energy transfer mechanisms among Er³⁺, Tm³⁺ and Yb³⁺ ions under 980 nm NIR excitation.

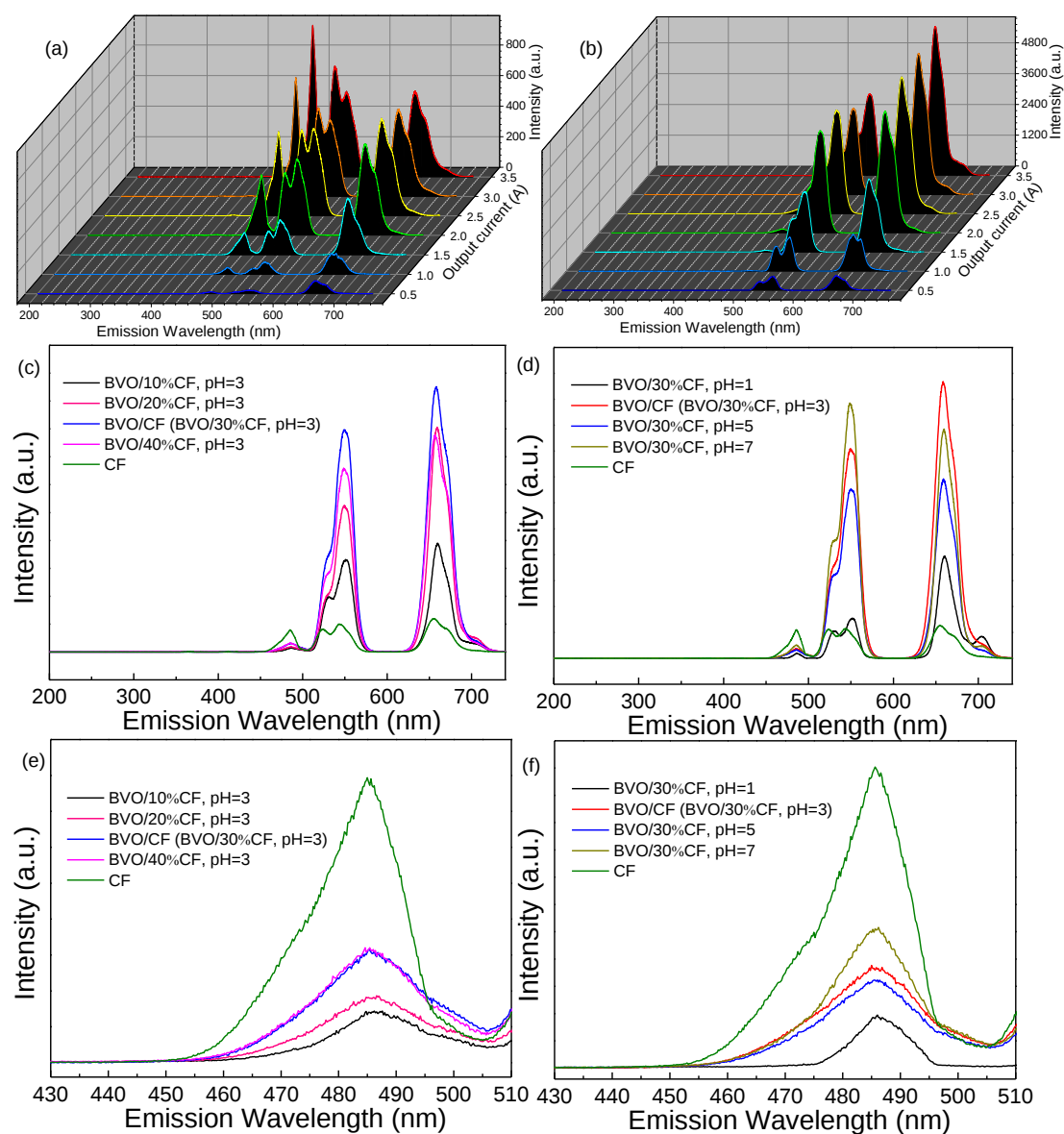


Fig. S5 Upconversion luminescence spectra of (a) CF and (b) BVO/CF under 980 nm NIR excitation with different powers (0.5-3.5 A). Upconversion luminescence spectra of CF and BVO/CF prepared with various (c, e) CF contents (power = 2.0 A) and (d, f) pH values (power = 2.5 A) under 980 nm NIR excitation.

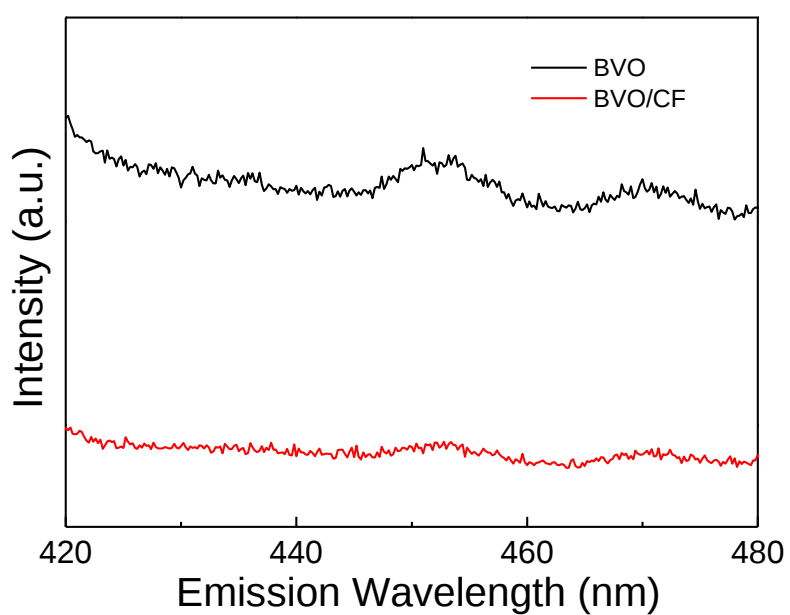


Fig. S6 PL emission spectra of pure BVO and the BVO/CF composite excited at 300 nm at room temperature.