

Supporting Information

Color Tunable Up-conversion Emission from ZrO_2 : Er^{3+} , Yb^{3+} Textile Fibers

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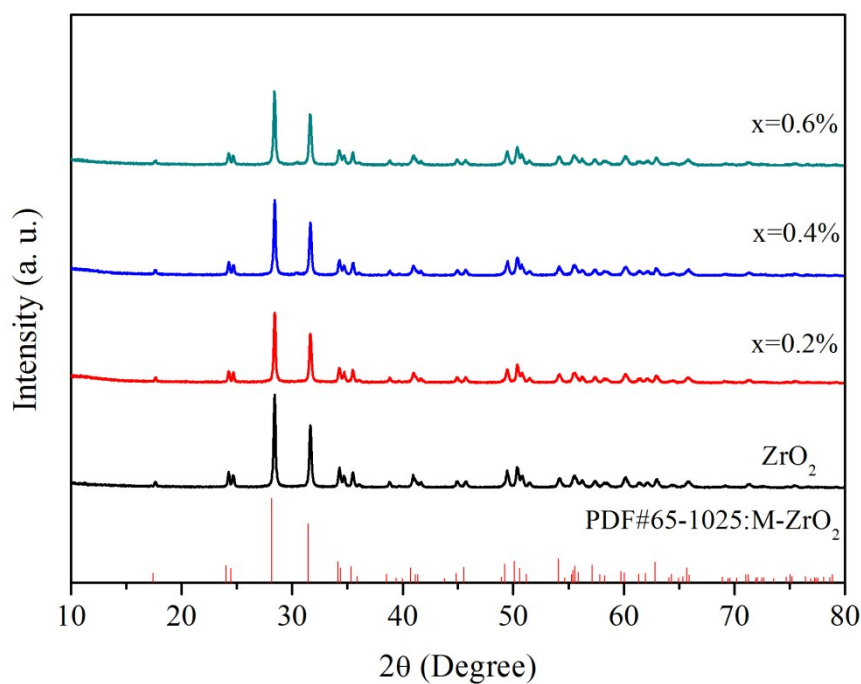


Figure S1 XRD patterns of 0 mol% Er^{3+} and x ($x=0.2-0.6$ mol%) Er^{3+} ions-doped ZrO_2 nanofibers annealed at 1000 °C for 1h and the standard card of monoclinic zirconia (PDF#65-1025).

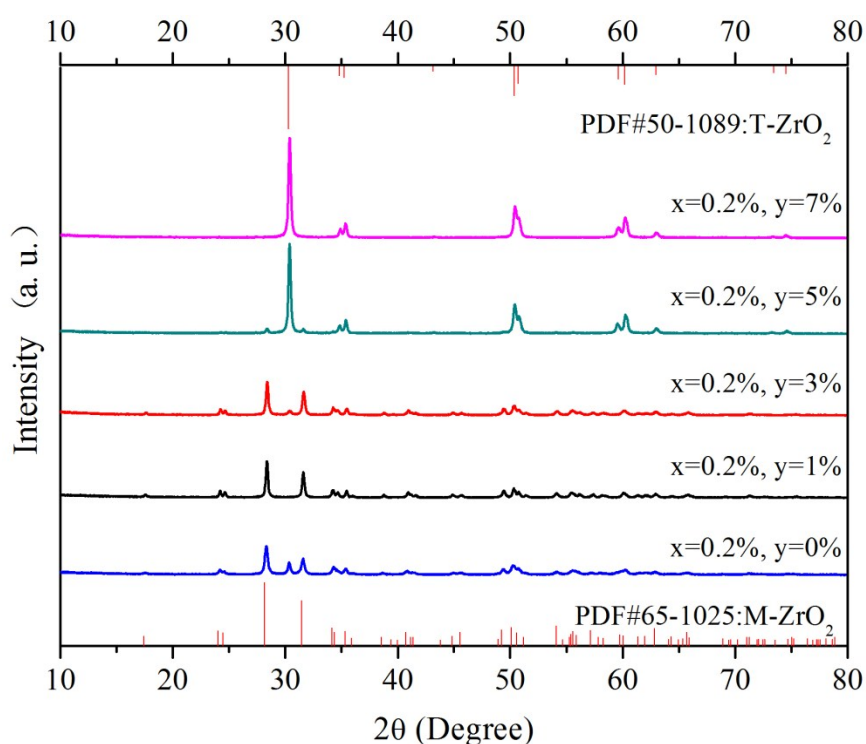


Figure S2 XRD patterns of 0.2 mol% Er^{3+} , y ($y=0-7$ mol %) Yb ions-doped ZrO_2 nanofibers annealed at 1000 °C for 1h and the standard cards of monoclinic zirconia (PDF#65-1025) and tetragonal zirconia (PDF#50-1089).

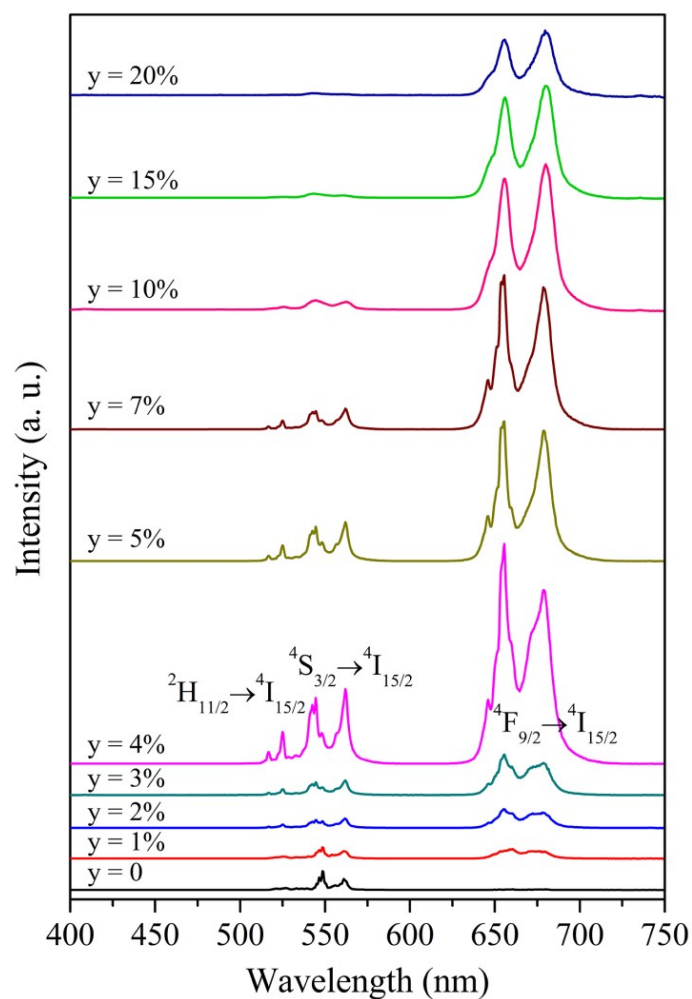


Figure S3 Emission spectra of 0.2 mol% Er³⁺ and y Yb³⁺ co-doped ZrO₂ samples prepared with a function of doped concentrations ($\lambda_{\text{ex}}=980$ nm).

Table 1 CIE 1931 coordinates for 0.2 mol%Er³⁺, y Yb³⁺ at 980 nm excitation wavelength as indicated.

$\lambda_{\text{ex}}=980$ nm	Er ³⁺ (x mol%)	Yb ³⁺ (y mol%)	X	Y
	0.2	0	0.3154	0.6747
	0.2	1	0.3738	0.6158
	0.2	2	0.4145	0.5759
	0.2	3	0.4386	0.5513
	0.2	4	0.4430	0.5476
	0.2	5	0.4564	0.5350
	0.2	7	0.5306	0.4622
	0.2	10	0.5613	0.4312
	0.2	15	0.6140	0.3808
	0.2	20	0.6821	0.3146

Table 2 Lifetime of ${}^2H_{11/2}/{}^4S_{3/2} \rightarrow {}^4I_{15/2}$ and ${}^4F_{9/2} \rightarrow {}^4I_{15/2}$ transitions in $ZrO_2: Er^{3+}, Yb^{3+}$ fibers under 980 nm excitation.

λ	545 nm				680 nm			
y	$\tau(\mu s)$	$\tau_1(\mu s)$ (%)	$\tau_2(\mu s)$ (%)	χ^2	$\tau(\mu s)$	$\tau_1(\mu s)$ (%)	$\tau_2(\mu s)$ (%)	χ^2
0 %	39.90	31.17 (92.21)	143.23 (7.79)	1.321	40.91	30.12 (90.7)	146.17 (9.3)	0.880
5 %	350.9	110.9 (19.64)	409.5 (80.36)	1.183	533.6	214.9 (30.86)	674.1 (69.32)	0.999
10 %	200.8	105.1 (57.75)	331.5 (42.25)	1.198	207.5	106.4 (59.37)	355.2 (40.63)	1.000
15 %	68.87	48.52 (61.08)	100.8 (38.92)	1.142	80.36	50.3 (62.38)	130.2 (37.62)	0.782
20 %	108.2	49.36 (57.71)	188.5 (42.29)	1.107	92.70	44.5 (64.16)	179.0 (35.84)	1.000