Supporting Information

Luminescence properties of Eu_2O_3 - doped ZrO_2 -Y_2O_3 single crystals

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Composition of the crystals

The compositions of the crystals are assumed to be the same as those of the mixtures from which they were synthesized, as shown in Table S1.

Table S1. Chemical compositions of Eu-doped single crystals

Sample number	Composition (mol%)		
	ZrO_2	Y_2O_3	Eu_2O_3
1	92.00	7.90	0.10
2	92.00	7.70	0.30
3	92.00	7.50	0.50
4	92.00	7.25	0.75
5	92.00	7.00	1.00
6	92.00	6.00	2.00
7	92.00	5.00	3.00

XRD Measurements

Table S2 Crystallite sizes of ground $(ZrO_2)_{92}(Y_2O_3)_{8-z}(Eu_2O_3)_z$ crystals

Sample number	z	crystallite sizes (nm)
1	0.10	25.1319
2	0.30	28.3565
3	0.50	29.6404
4	0.75	30.4248
5	1.00	30.5094
6	2.00	30.8030
7	3.00	31.1846

SEM images at different magnification

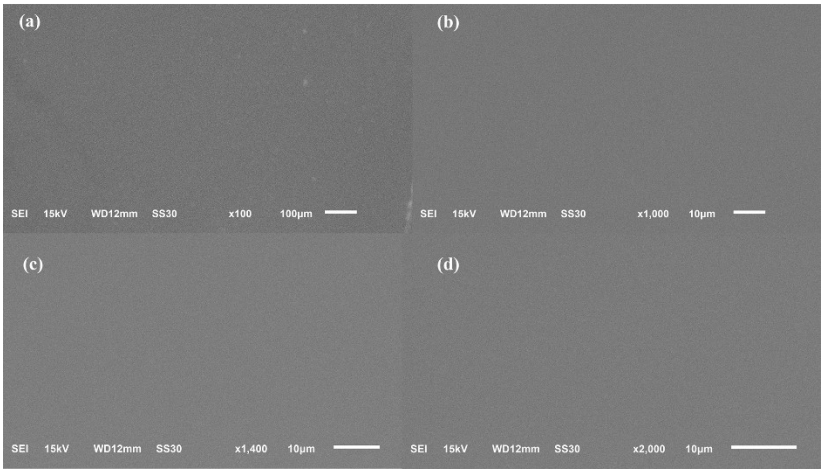

Fig. S1. SEM images of $(ZrO_2)_{92}(Y_2O_3)_{6.00}(Eu_2O_3)_{2.00}$ crystal at magnification of (a) ×100, (b) ×1000, (c) ×1400, and (d) ×2000.

These images confirm that there are no cracks, or other defects associated with the crystal surface.

Transmission spectra for selected crystal discs prepared with composition $(ZrO_2)_{92}(Y_2O_3)_{8-z}(Eu_2O_3)_z$

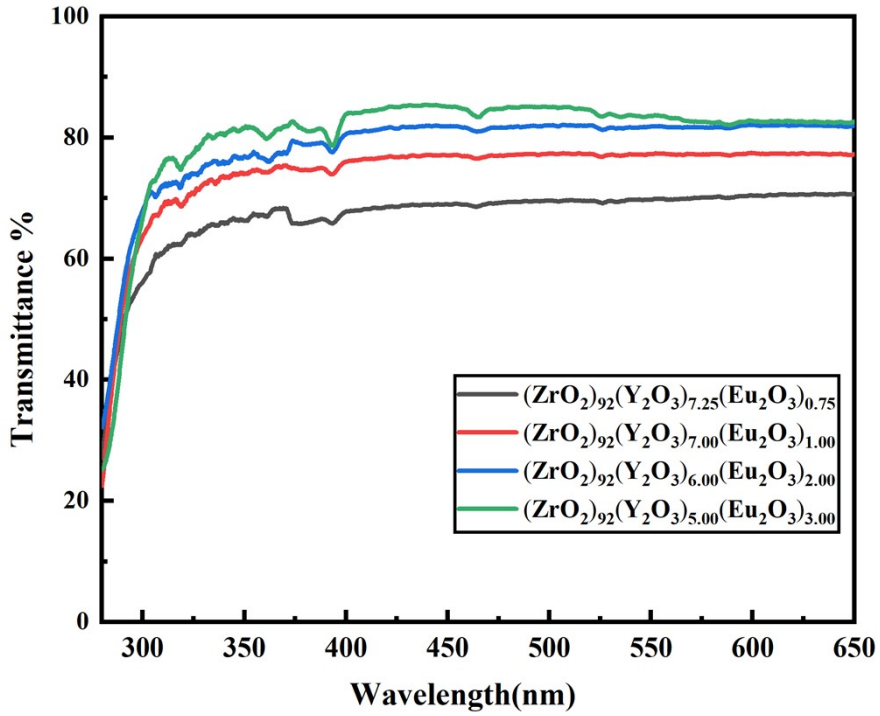

Fig. S2. Transmission spectra of $(ZrO_2)_{92}(Y_2O_3)_{8-z}(Eu_2O_3)_z$ crystals with values for z of 0.75, 1.00, 2.00, and 3.00.

The transmittance in the range 325 – 600 nm increases as Y^{3+} is replaced by Eu^{3+}, with the average value being ~75% for samples with z in the range 0.75 – 3.00.

Mapping elemental contents by EDX spectroscopy

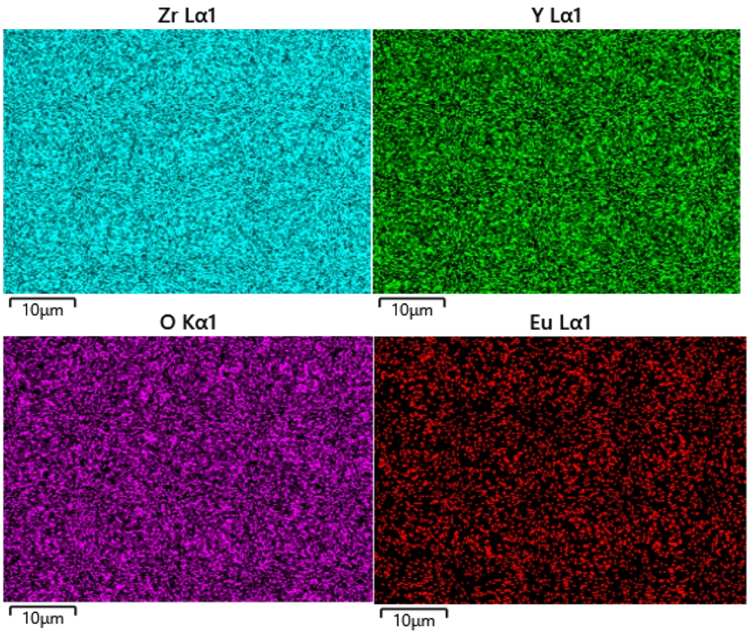

Fig. S3. Element distribution on the surface of a $(ZrO_2)_{92}(Y_2O_3)_{6.00}(Eu_2O_3)_{2.00}$ crystal

These results show a completely random distribution of the elements at the sub-micrometre resolution.

Fluorescence decay measurements for $(ZrO_2)_{92}(Y_2O_3)_{8-z}(Eu_2O_3)_z$ crystals

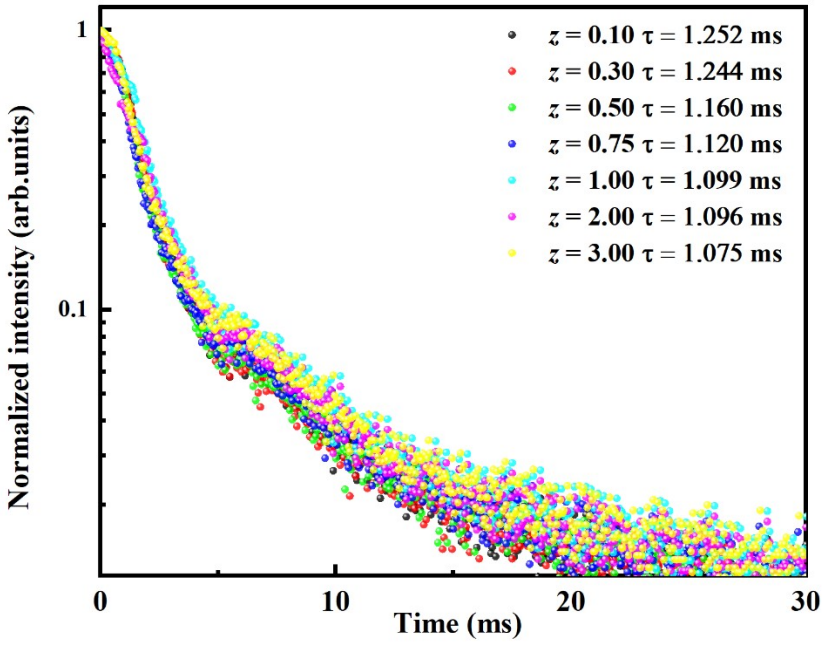

Fig.S4 Fluorescence decay curve for $(ZrO_2)_{92}(Y_2O_3)_{8-z}(Eu_2O_3)_z$ crystals

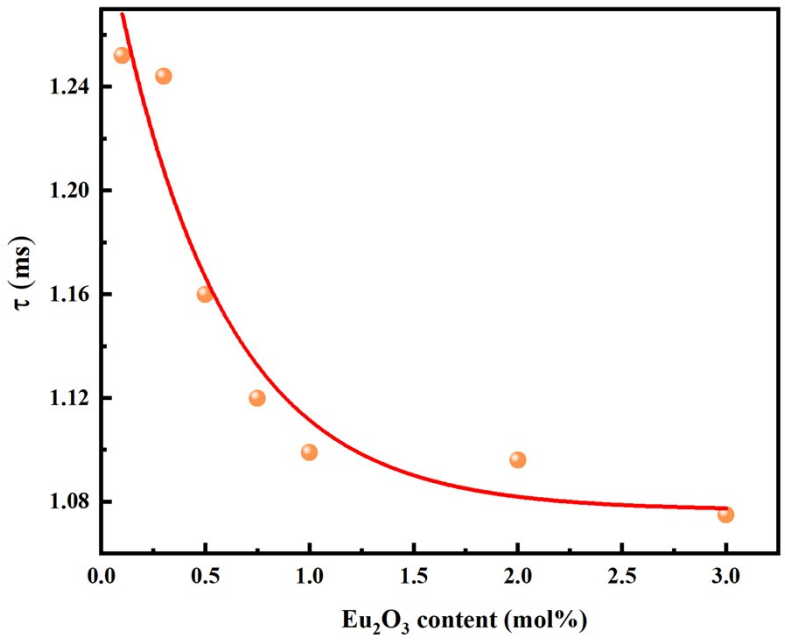

Fig. S5 Variation of the fluorescence lifetime, τ, with Eu_2O_3 content, z, of $(ZrO_2)_{92}(Y_2O_3)_{8-z}(Eu_2O_3)_z$ crystals