Electronic Supplementary Material (ESI) for RSC Advances.

Supplementary Material

Unveiling the Role of the Hexagonal Polymorph on $SrAl_2O_4$-based Phosphors

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Supplementary Information 1:

Figure S1 exhibits the calculated lattice cell parameters and cell volume as a function of ZnO content ((1.25, 2.5, 3.75 and 5% (in weight)) for the $SrAl_2O_4$:Eu, Dy (SAO) powders synthesized at 1000 ºC for 2 h in $90N_2$-$10H_2$ atmosphere, using a salt/$SrAl_2O_4$ molar ratio of 3:1 and γ-Al_2O_3 /SrO ratio of 2.

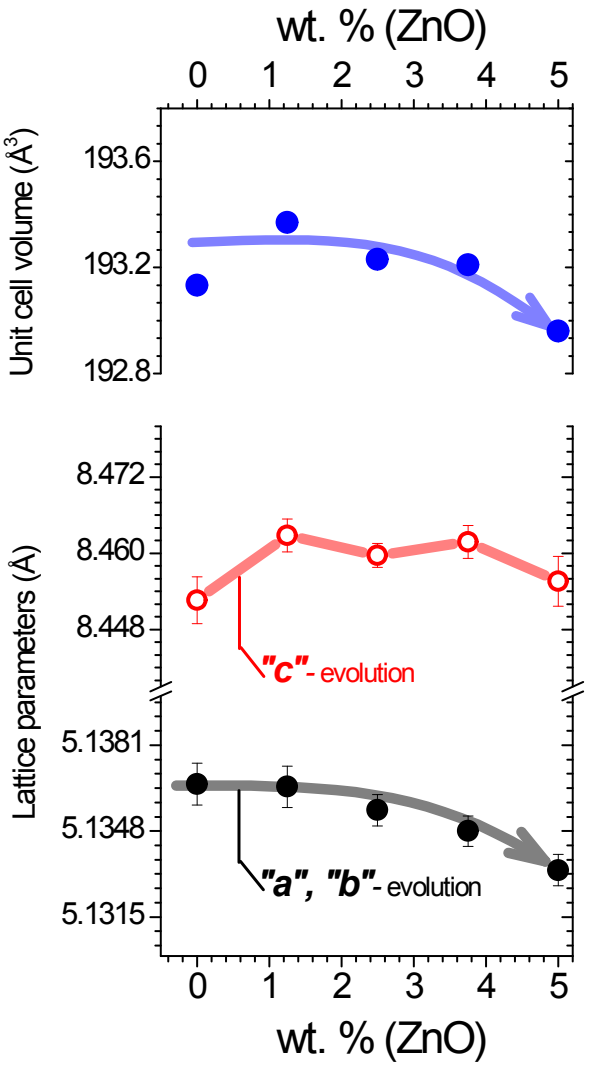

Figure S1. Lattice cell parameters and crystal unit cell volume as a function of ZnO content: From synthesized $SrAl_2O_4$:Eu, Dy (SAO) phosphor at 1000 ºC for 2 h in $90N_2$-$10H_2$ atmosphere, using a salt/$SrAl_2O_4$ molar ratio of 3:1 and γ-Al_2O_3 /SrO ratio of 2 with different ZnO content (1.25, 2.5, 3.75 and 5% (in weight)).

Supplementary Information 2:

Figure S2(a) shows the XRD of the synthesized powder heated at 1000 ºC for 2 h in $90N_2$-$10H_2$ atmosphere, employing a salt/$SrAl_2O_4$ molar ratio of 3:1, a Al_2O_3 /SrO ratio of 2, and as alumina precursor γ-Al_2O_3 with 10% of ZnO. Here it is essential to note that the non-stoichiometric ratio promotes the formation of the hexagonal phase and 10 % of ZnO promotes the secondary phase, $Sr_3Al_2O_6$. **Figure S1(b)** illustrates the emission spectra of samples with different ZnO contents; showing that the emission intensity decreases with ZnO contents higher than 5 %.

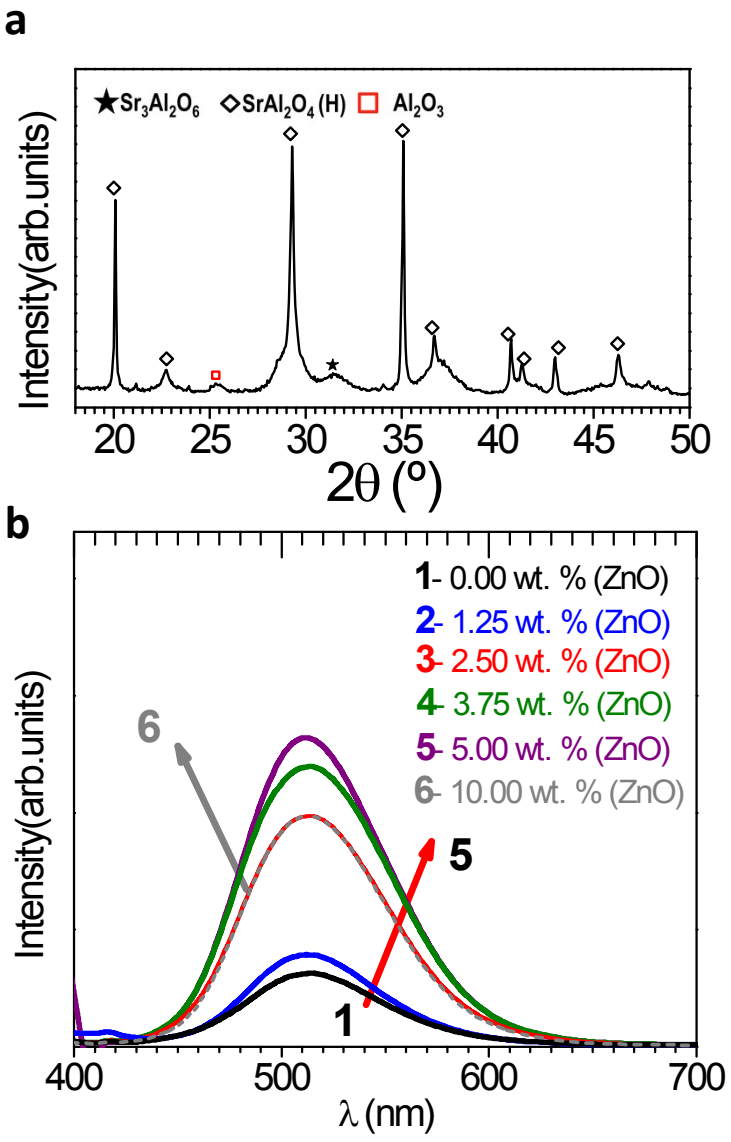

Figure S2. (a) XRD of synthesized $SrAl_2O_4$:Eu, Dy (SAO) phosphor heated at 1000 ºC for 2 h in $90N_2$-$10H_2$ atmosphere, employing a salt/$SrAl_2O_4$ molar ratio of 3:1, a Al_2O_3 /SrO ratio of 2, and as alumina precursor γ-Al_2O_3 with 10% of ZnO. The symbols highlight $SrAl_2O_4$ Hexagonal phase (black-open diamonds), $Sr_3Al_2O_6$ phase (black starts) and Al_2O_3 phase (red-open squares). **(b)** Emission spectra upon excitation at 380 nm of synthesized $SrAl_2O_4$:Eu, Dy as a function of ZnO incorporation.

Supplementary Information 3:

The chemical composition of the powder synthesized $SrAl_2O_4$:Eu, Dy without ZnO (Areas 1, 2, 3 ,4 and 5) and **w**ith 5 wt. % of ZnO (Areas 6 and 7) was determined by an INCA x-sight energy dispersive X-ray spectrometer (EDXS, Oxford Instruments) which is coupled with the FE-SEM.

Analyzed compositions of the areas from micrographs in **Fig. 4 (a-h)** presented in the main manuscript are summarized in **Table S1**.

Table S1. Elemental analysis from $SrAl_2O_4$:Eu, Dy powder synthesized without and with 5 wt. % of ZnO. * Al^{+3} cation excess (Al_2O_3)

Samples	Sr Atomic %	Al Atomic %	O Atomic %	Eu Atomic %	Dy Atomic %	Zn Atomic %
$SrAl_2O_4$:Eu,Dy Stoichiometric	13.9	28.6	57.1	0.3	0.1	-
$SrAl_2O_4$:Eu,Dy + Al_2O_3*	8.1	33.3	58.3	0.2	0.1	-
$SrAl_2O_4$:Eu,Dy + Al_2O_3* + 5% ZnO	8.0	33.1	58.1	0.2	0.1	0.4
Area 1	9.0	32.7	58.2	0.2	0.0	-
Area 2	9.5	32.1	58.1	0.2	0.1	-
Area 3	9.5	32.0	58.1	0.3	0.0	-
Area 4	9.0	32.1	58.2	0.6	0.0	-
Area 5	9.5	32.1	58.1	0.2	0.1	-
Area 6	11.9	29.0	57.4	0.4	0.1	1.3
Area 7	9.6	29.7	57.5	0.2	0.0	3.0

Supplementary Information 4:

The chemical composition of the powder synthesized $SrAl_2O_4$:Eu, Dy without ZnO (Point 1 and 2) and with 5wt. % of ZnO (Point 1´) was determined by an INCA x-sight energy dispersive X-ray spectrometer (EDXS, Oxford Instruments) which is coupled with the FE-SEM.

Analyzed Compositions of the points from micrographs in **Fig. 5** and **6** presented in the main manuscript are summarized in **Table S2**.

Table S2. Elemental analysis from $SrAl_2O_4$:Eu, Dy powder synthesized without and with 5% of ZnO. * Al^{+3} cation excess (Al_2O_3)

Samples	Sr Atomic %	Al Atomic %	O Atomic %	Eu Atomic %	Dy Atomic %	Zn Atomic %
$SrAl_2O_4$:Eu,Dy Theoretical Stoichiometric	13.9	28.6	57.1	0.3	0.1	-
$SrAl_2O_4$:Eu,Dy + Al_2O_3*	8.1	33.3	58.3	0.2	0.1	-
$SrAl_2O_4$:Eu,Dy + Al_2O_3* + 5% ZnO	8.0	33.1	58.1	0.2	0.1	0.4
Point 1	6.1	60.0	33.8	0.0	0.0	-
Point 2	0.9	36.1	62.5	0.0	0.0	-
Point 1´	8.1	33.9	58.0	0.0	0.0	0.0