## Mechanoluminescence (ML), Thermoluminescence (TL), Optically stimulated luminescence (OSL) and photoluminescence (PL) in SrAl<sub>2</sub>O<sub>4</sub>:Eu nanophosphor: effects of particle size and annealing in different atmospheres

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## Supplementary data

Figure S-1: Experimental set up for taking ML by applying pressure with constant pressing rate. All different parts of the equipment are listed in the inset.



Figure S-2: Rietveld refinement of a typical XRD pattern of the SAOE ML phosphor. Experimental data has also been shown for comparison. Very good fit between the simulated pattern and the experimental one could be seen in the figure.



Figs. S-3(A), S-3(B-F), respectively, for particles in the particle size range of 250-150  $\mu m$ . The EDS spectrum is shown in Fig S-3(G) and a table consisting of the composition of the material in atomic% and weight% is also shown in its inset. Similar data for all the other particle sizes is also shown in Figs. S-4(A), S-4(B-F) and S-4(G), Figs. S-5(A), S-5(B-F) and S-5(G), Figs. S-6(A), S-6(B-F) and S-6(G), Figs. S-7(A), S-7(B-F) and S-7(G), Figs. S-8(A), S-8(B-F) and S-8(G), Figs. S-9(A), S-9(B-F) and S-9(G) and Figs. Figs. S-10(A), S-10(B-F) and S-10(G) for the average particle sizes 150-105, 105-75, 75-45, 0.55  $\mu m$ , 77 nm, 47 nm and 32 nm, respectively.

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Fig. S-3
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692 Cnts 1.130 keV Det: Octane Elect Super









Lsec: 10.2 116 Cnts 1.130 keV Det: Octane Elect Super







Fig. S-11: Effect of impurity concentration on the ML peak intensity of SrAl<sub>2</sub>O<sub>4</sub>: Eu phosphor material. The variation of the ML peak intensity with impurity concentration is also shown in the inset. The maximum ML peak intensity was found to be for 1.5 mol% impurity concentration.



Fig. S-12: ML glow curves of SAOE phosphor after annealing in air. The variation of the EML intensity with the annealing temperature is also shown in the inset.



Fig. S-13: Determination of induced strain in nanomaterials of different particles due to ball milling: a) 550 nm, b) 77 nm, c) 47 nm, d) 32 nm.

