Supporting information

Mn^{2+} activated Ca-α-SiAlON – Broadband deep-red luminescence and sensitization by Eu^{2+}, Yb^{2+} and Ce^{3+}

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Contents:

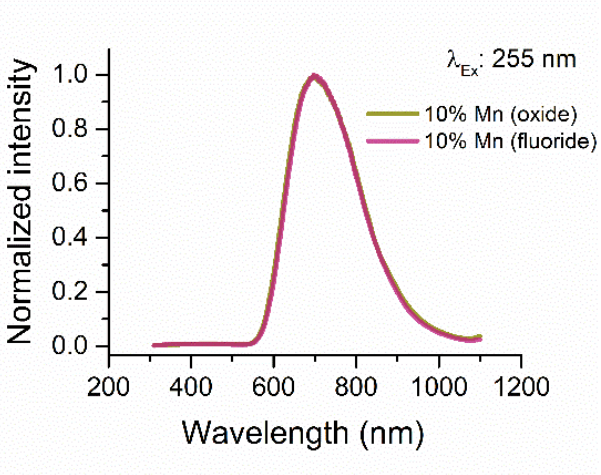

Figure S1: Normalized PL emission spectra of Mn^{2+} (10 at.%) doped Ca-α-SiAlON samples obtained using fluoride and oxide doping precursors.

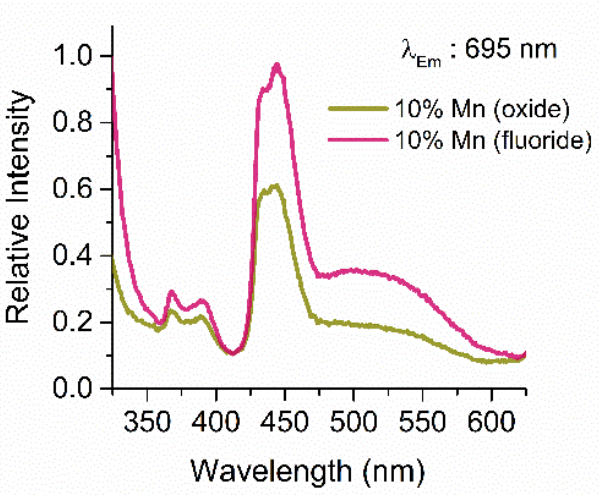

Figure S2: PLE spectra of Mn^{2+} (10 at.%) doped Ca-α-SiAlON samples obtained using fluoride and oxide doping precursors.

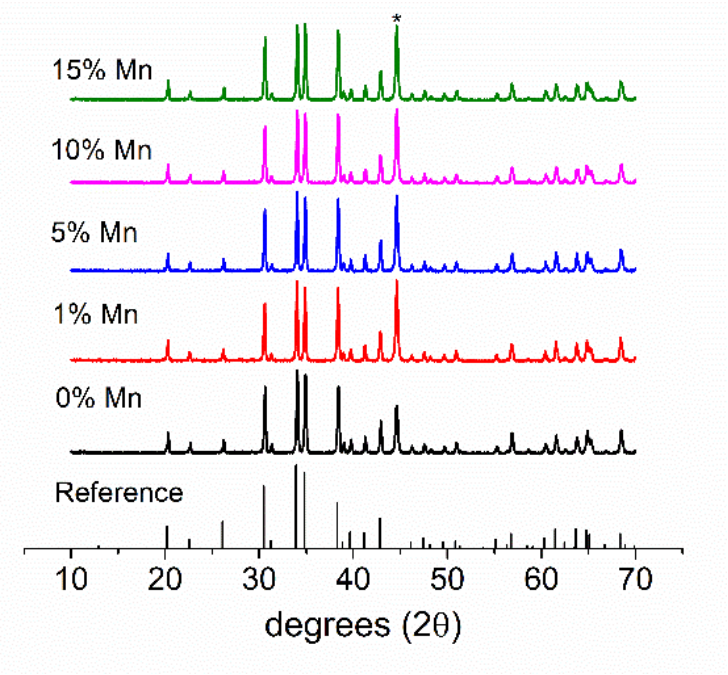

Figure S3: PXRD patterns of Ca-α-SiAlON samples doped with 0 – 15 at.% Mn^{2+} contents. Al sample holder reflections appear at about 39^0, 45^0 and 65^0.

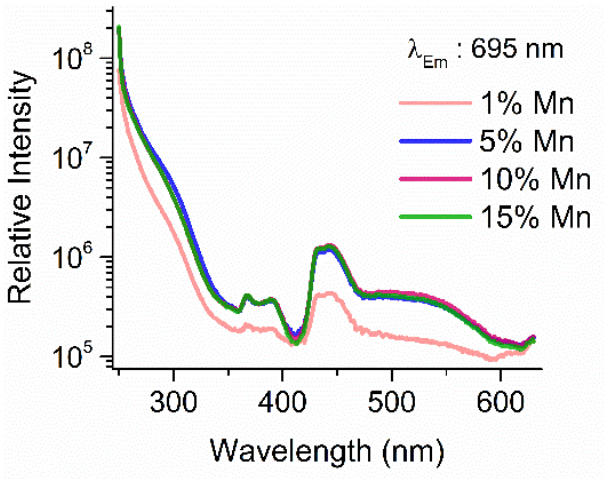

Figure S4: PLE spectra of Mn^{2+} (1 – 15 at.%) doped Ca-α-SiAlON in semi-log scale. The charge transfer band (< 350 nm) exhibits maximum intensity for 5 at.% Mn^{2+} contents, whereas the d-d transition bands (> 350 nm) exhibits maximum for 10 at.% Mn^{2+}.

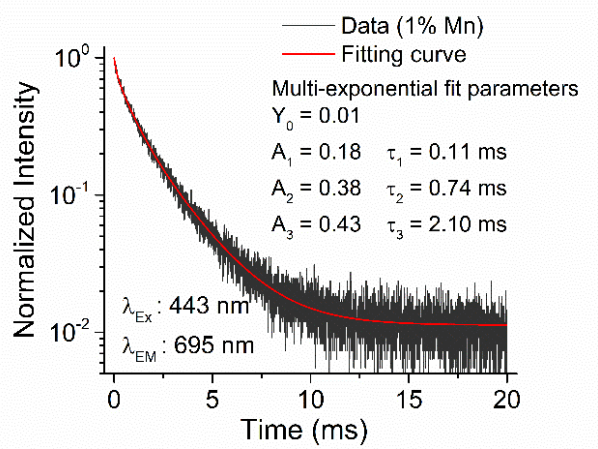

Figure S5: Mn^{2+} PL decay curve in 1 at.% doped Ca-α-SiAlON and respective multi-exponential fit. The curve exhibits good fit with three exponential fitting. The slowest component exhibits decay lifetime of 2.1 ms.

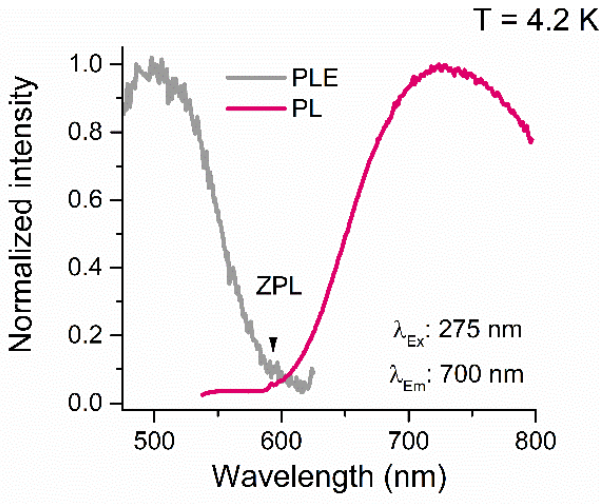

Figure S6: Mn^{2+} PL-PLE spectra at 4.2 K. The zero phonon line (ZPL) is weak and is estimated to be at around 593 nm. The PL-PLE crossing point also occurs at around 593 nm.

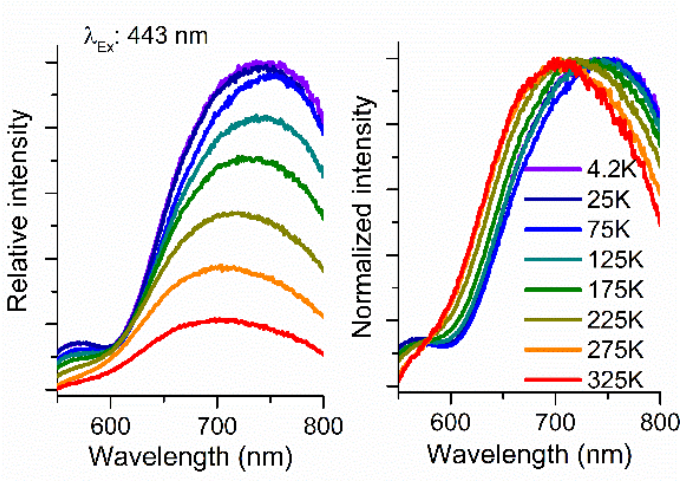

Figure S7: Temperature dependent PL spectra of Mn^{2+} (10 at.%) doped Ca-α-SiAlON under 443 nm excitation.

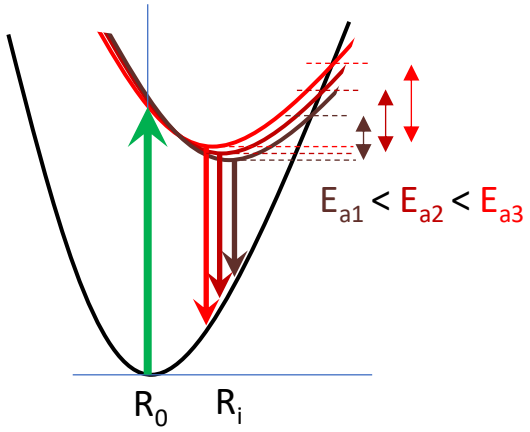

Figure S8: Schematic configuration crossover model suggesting lower activation energy (E_a) for red-shifted emission transitions.

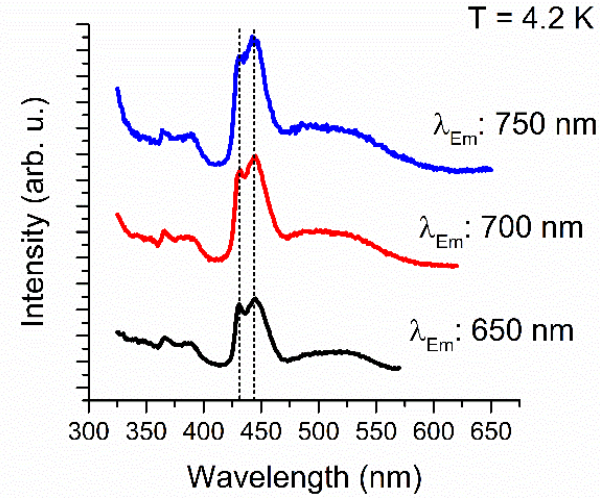

Figure S9: 4.2 K PLE spectra of Mn^{2+} (10 at.%) doped Ca-α-SiAlON monitoring at different emission regions. The PLE feature reveals prominent variation at 428 nm and 443 nm with respect to monitoring wavelength.

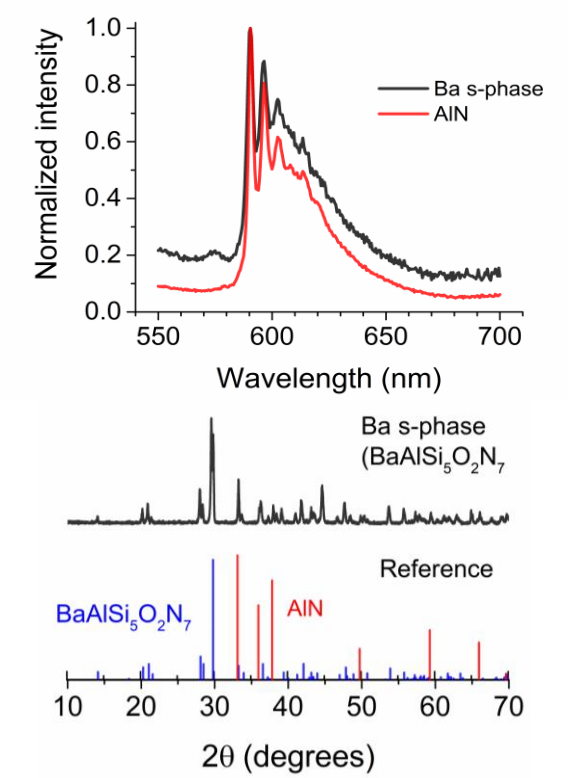

Figure S10: 4.2 K vibronic fine-structure of Mn^{2+} orange-red PL observed in Ba s-phase and AlN (top). PXRD pattern of Ba s-phase and reference patterns (bottom). Al sample holder reflections appear at about 39^0, 45^0 and 65^0.

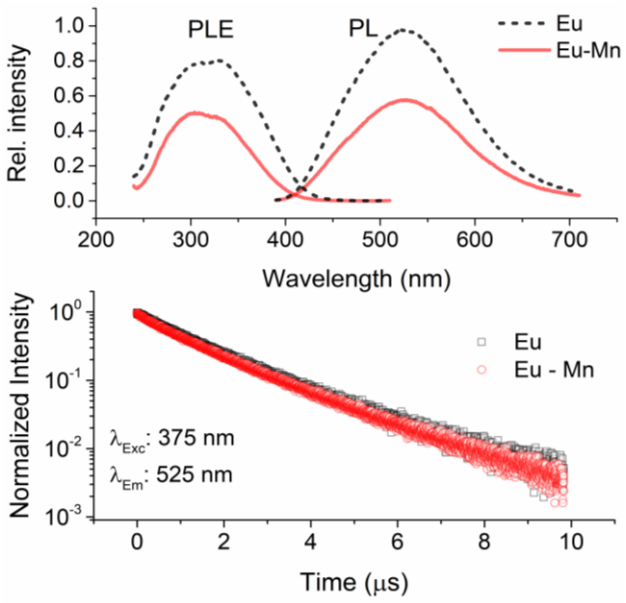

Figure S11: PL-PLE spectra of Eu^{2+} singly doped and Eu^{2+}-Mn^{2+} codoped Ba s-phase compounds (top). Eu^{2+} PL decay curves in singly and codoped samples (bottom). The dopant concentration is 5 at% for Eu^{2+} as well as Mn^{2+}.