Supplementary Material

Atomic layer deposition of Er-doped yttrium aluminum gallium garnet nanofilms with tunable crystallization and electroluminescence properties

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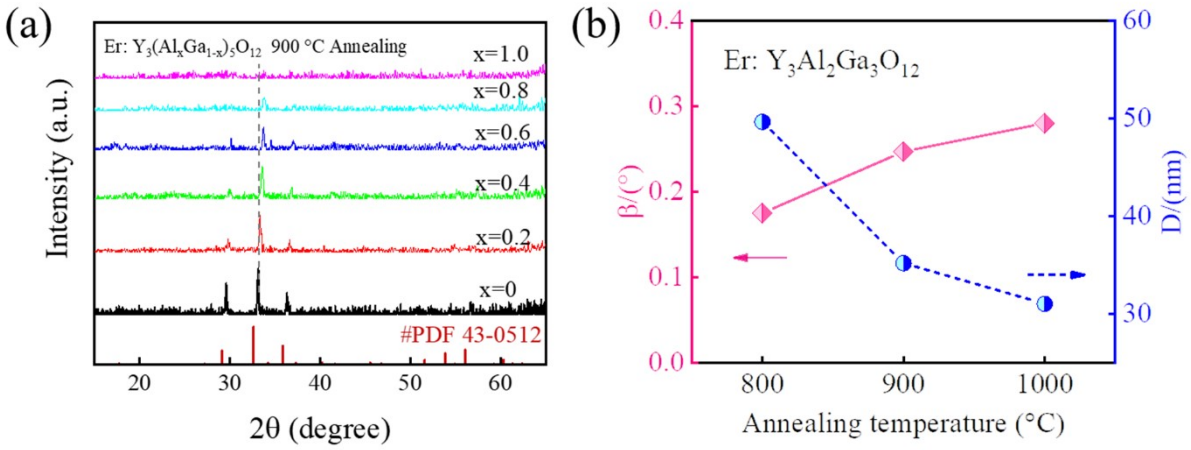

Figure S1. (a) XRD patterns of Er-doped $Y_3(Al_xGa_{1-x})_5O_{12}$ nanofilms with different Al contents that annealed at 900 °C. (b) The distribution of β(FWHM) and D (calculated crystallite size) in the $Y_3Al_2Ga_3O_{12}$ (x=0.4) nanolaminates annealed at different temperatures.

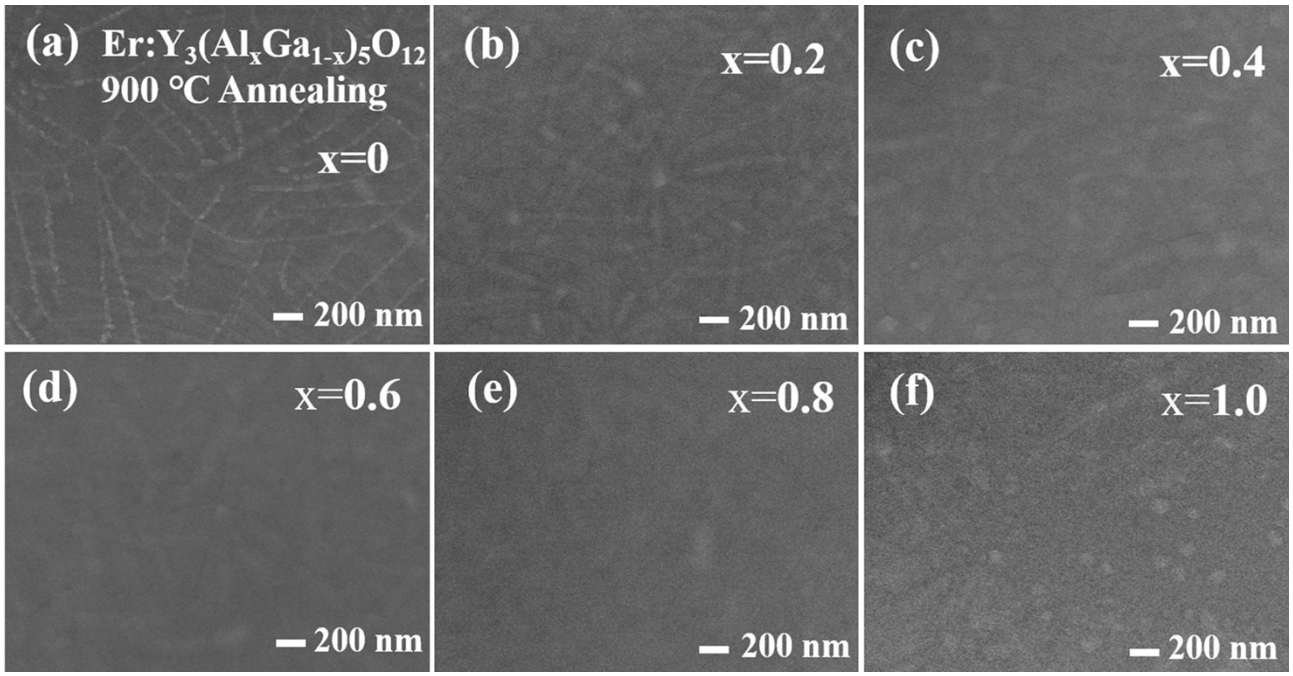

Figure S2. SEM images of the 900 °C annealed Er-YAGG nanofilms with different Al contents.

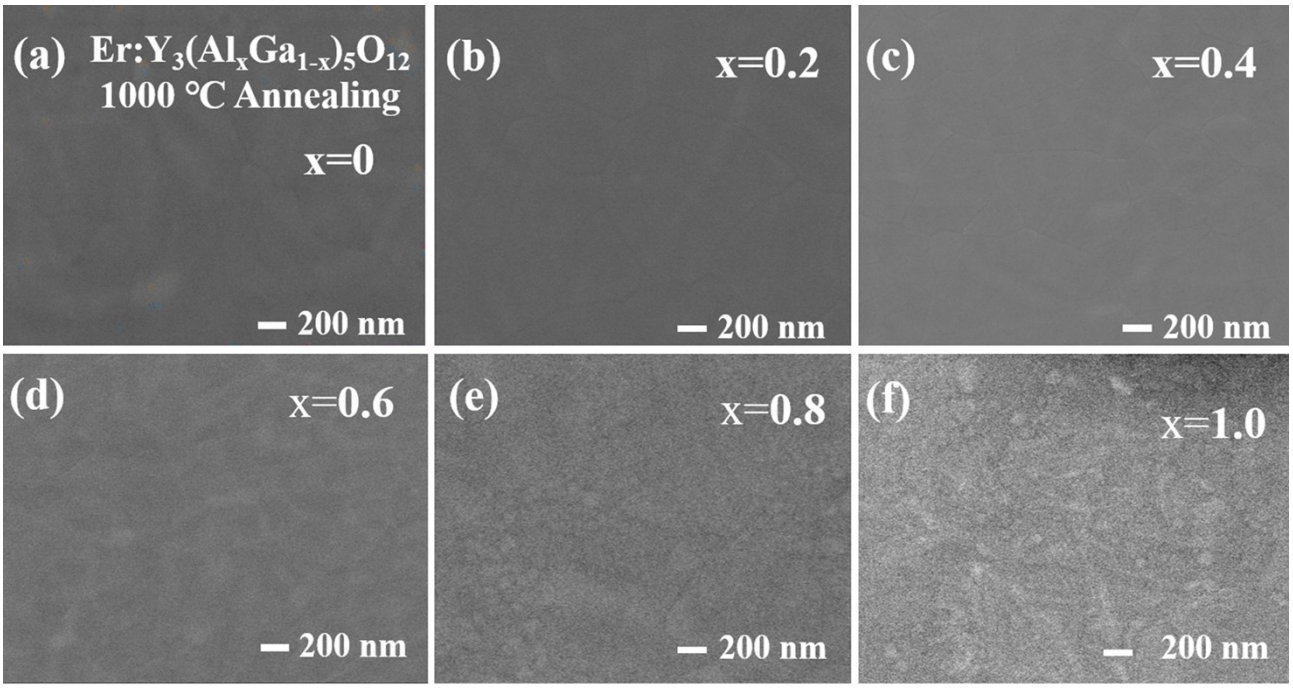

Figure S3. SEM images of the 1000 °C annealed Er-YAGG nanofilms with different Al contents.

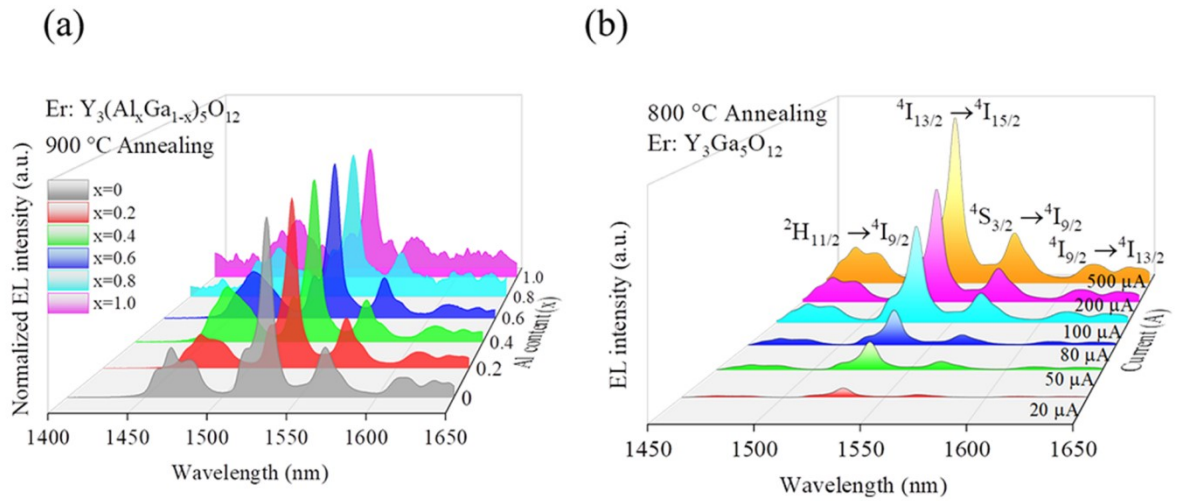

Figure S4. (a) The Normalized NIR EL spectra of Er-YAGG MOSLEDs with different Al contents annealed at 900 °C. (b) The NIR EL spectra from the MOSLEDs based on the 800 °C annealed $Y_3Ga_5O_{12}$:Er nanofilms under different injection currents.

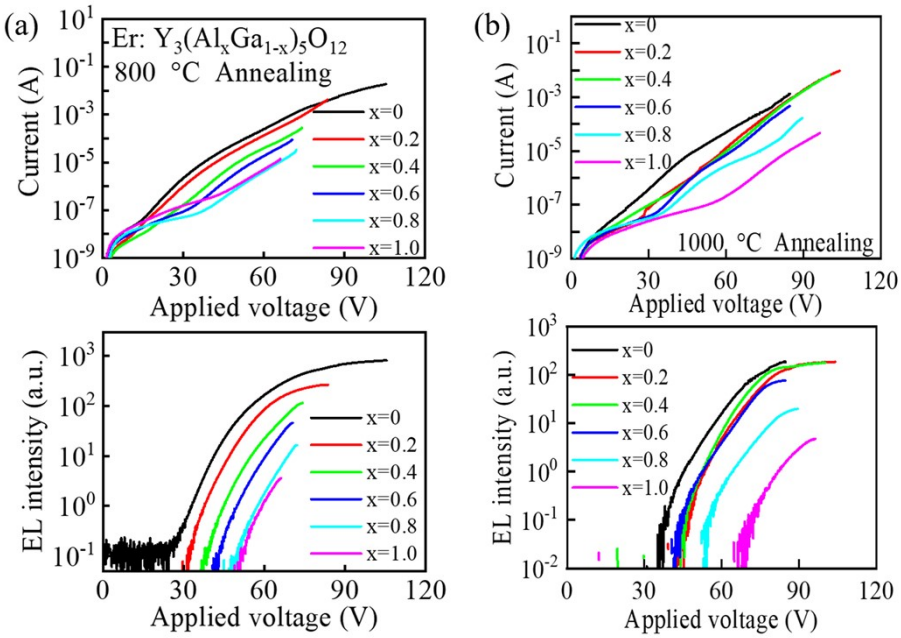

Figure S5. The dependence of the 1530 nm EL intensities and the injection currents on the applied voltages for the Er-YAGG MOSLEDs with different Al contents annealed at (a) 800 °C and (b) 1000 °C.

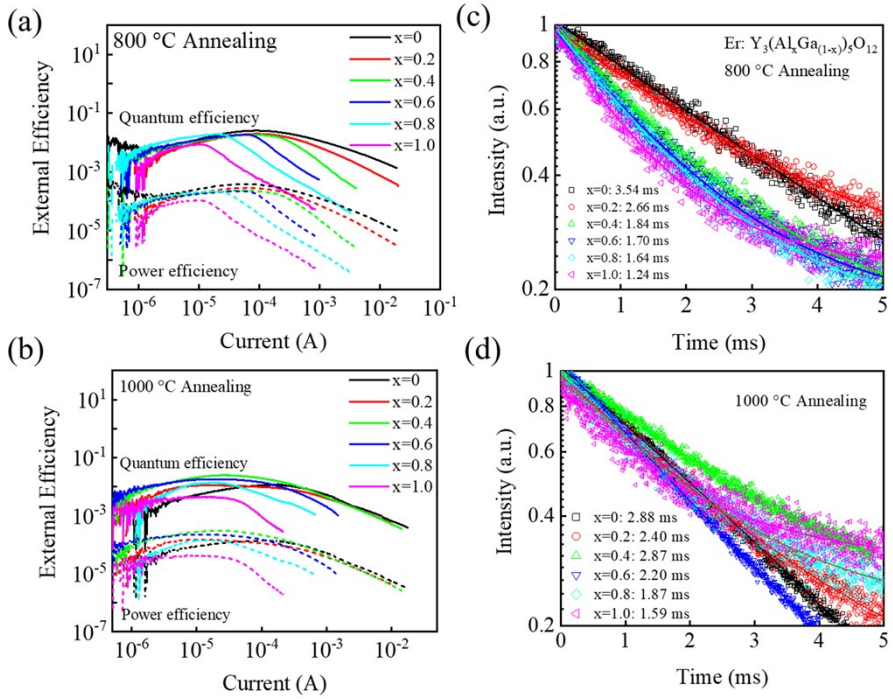

Figure S6. Power efficiencies and external quantum efficiencies versus the injection currents of Er-YAGG MOSLEDs with different Al contents annealed at (a) 800 °C and (b) 1000 °C. Their EL decay traces are compared in (c) and (d), respectively.

Table S1. The EL intensity (a.u.), power density, EQE and EL decay lifetime τ from the Er-YAGG nanolaminate MOSLEDs with different annealing temperatures and Al contents.

Er: YAGG	800 °C Annealing				900 °C Annealing				1000 °C Annealing			
	EL	Power Density (mW/cm^2)	EQE (%)	τ (ms)	EL	Power Density (mW/cm^2)	EQE (%)	τ (ms)	EL	Power Density (mW/cm^2)	EQE (%)	τ (ms)
x=0	814	10.03	2.51	3.54	270	3.36	1.9	3.36	260	3.12	1.2	2.88
x=0.2	265	3.23	1.99	2.66	165	2.01	1.67	2.56	190	2.27	1.1	2.40
x=0.4	118	1.42	1.80	1.84	140	1.67	3.29	3.10	160	2.17	2.41	2.87
x=0.6	43	0.50	1.70	1.70	118	1.39	2.8	2.43	75	0.93	1.7	2.20
x=0.8	16.5	0.16	1.90	1.64	22	0.26	0.64	1.85	27	0.27	1.3	1.87
x=1.0	3.4	0.03	0.70	1.24	4.5	0.05	0.8	1.58	4.7	0.06	0.45	1.59