Electronic Supplementary Information (ESI)

Doping alkaline-earth: a strategy of stabilizing hexagonal GdF_3 at room temperature

Qi Zhao,[ab] *Baiqi Shao,*[ab] *Wei Lü,*[b] *Yongchao Jia,*[ab] *Wenzhen Lv,*[ab] *Mengmeng Jiao*[ab]*, and Hongpeng You**[a]

[a]State Key Laboratory of Rare Earth Resource Utilization, Changchun Institute of Applied Chemistry, Chinese Academy of Sciences, Changchun 130022, P. R. China.

[b]University of the Chinese Academy of Sciences, Beijing 100049, P. R. China.

[*]Corresponding author: E-mail address: hpyou@ciac.ac.cn

Table S1

Amount of $LnCl_3$ (1 mol/L) (mL)	Amount of MCl_2 (mL) (1 mol/L) (mL)	Nominal composition (mol %)	Content by EDS (mol %)
Gd 0.9	Sr 0.1	Sr 10	Sr 0
Gd 0.8	Sr 0.2	Sr 20	Sr 8.2
Gd 0.7	Sr 0.3	Sr 30	Sr 9.3
Gd 0.6	Sr 0.4	Sr 40	Sr 10.6
Gd 0.5	Sr 0.5	Sr 50	Sr 11.9
Gd 0.4	Sr 0.6	Sr 60	— —
Gd 0.3	Sr 0.7	Sr 70	— —
Gd 0.9	Ca 0.1	Ca 10	Ca 0
Gd 0.8	Ca 0.2	Ca 20	Ca 5.0
Gd 0.7	Ca 0.3	Ca 30	Ca 7.3
Gd 0.6	Ca 0.4	Ca 40	Ca 8.7
Gd 0.5	Ca 0.5	Ca 50	Ca 9.6
Gd 0.4	Ca 0.6	Ca 60	— —
Gd 0.3	Ca 0.7	Ca 70	— —
Gd 0.95 Eu 0.05	0	— —	Eu 6.2
Gd 0.76 Eu 0.04	Sr 0.2	Sr 20	Sr 7.1 Eu 5.8
Gd 0.8 Yb 0.18 Er 0.02	0	— —	— —
Gd 0.64 Yb 0.144 Er 0.016	Sr 0.2	Sr 20	— —

Table S2

Nominal content of La (mol %)	10	20	30	40	50	60	20
Amount of $Gd(Eu)Cl_3$ (1 mol/L) (mL)	0.9	0.8	0.7	0.6	0.5	0.4	Gd 0.76 Eu 0.04
Amount of $LaCl_3$ (1 mol/L) (mL)	0.1	0.2	0.3	0.4	0.5	0.6	0.2

Table S3

Nominal content of Sr (mol %)	20	30	40	50
Cell parameters (Å)	a = b = 6.889 c = 7.065	a = b = 6.896 c = 7.075	a = b = 6.899 c = 7.079	a = b = 6.905 c = 7.086

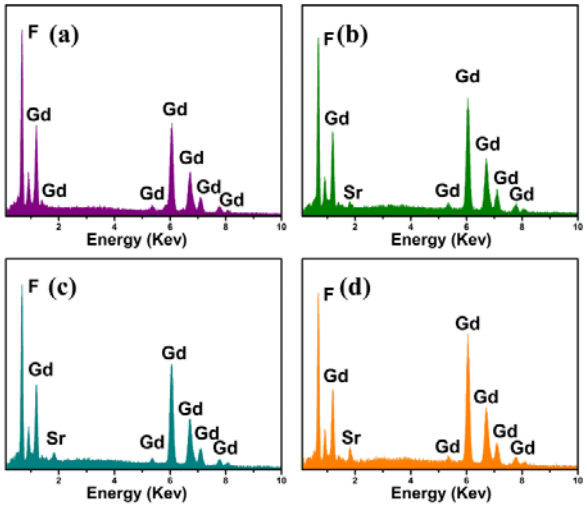

Fig. S1 The EDS spectra of the Sr-doped GdF_3 with different nominal compositions: (a) 10 mol%, (b) 20 mol%, (c) 30 mol%, (d) 50 mol%

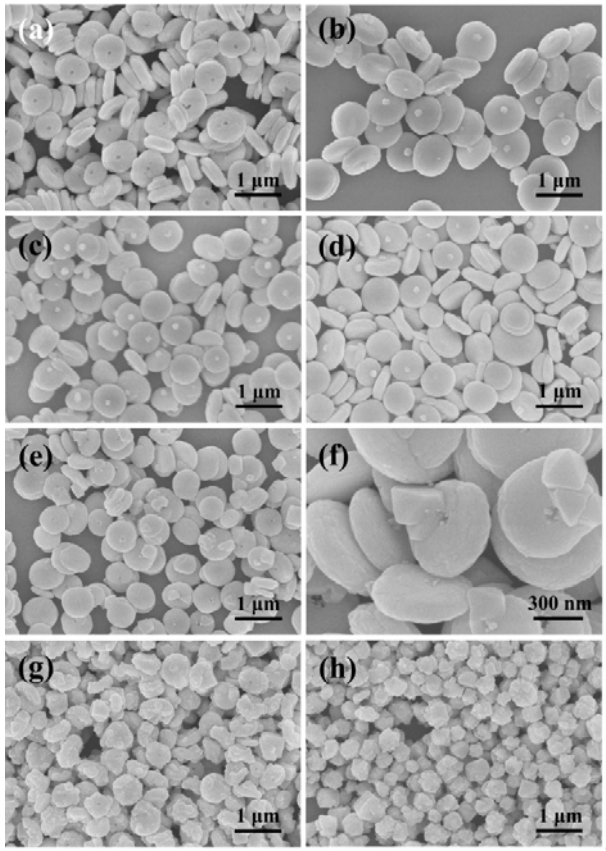

Fig. S2 The SEM images of the Ca-doped GdF_3 with different nominal compositions: (a) 10 mol%, (b) 20 mol%, (c) 30 mol%, (d) 40 mol%, (e,f) 50 mol%, (g) 60 mol%, and (h) 70 mol%.

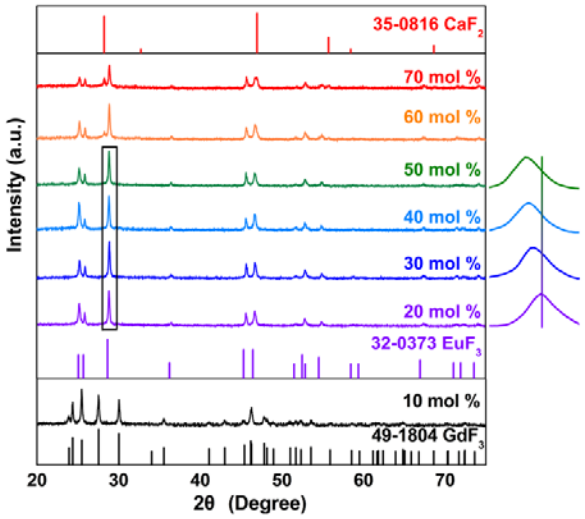

Fig. S3 The XRD patterns of the Ca-doped GdF_3 with different nominal compositions. The right is partial enlarged detail from 28.6 to 29.1 degree.

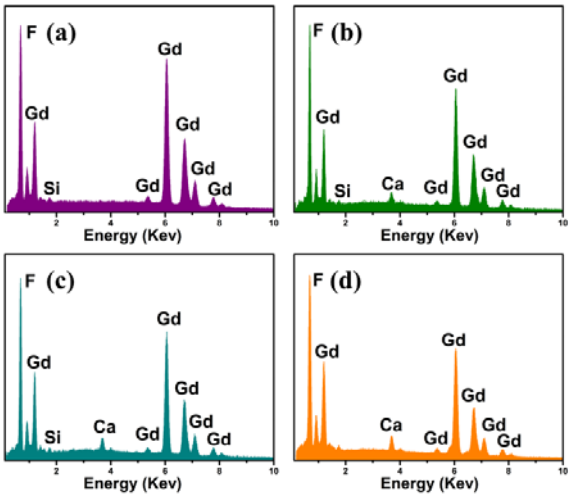

Fig. S4 The EDS spectra of of the Ca-doped GdF_3 with different nominal composition: (a) 10 mol%, (b) 20 mol%, (c) 30 mol%, (d) 50 mol%.

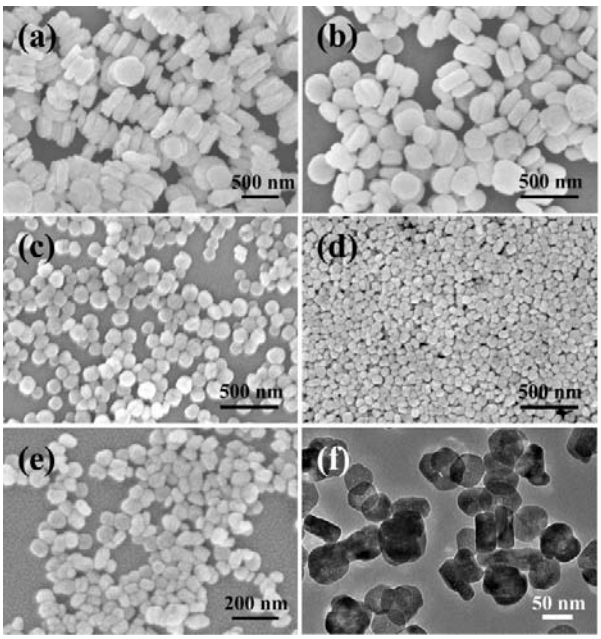

Fig. S5 The SEM images of the La-doped GdF_3 with different nominal compositions: (a) 10 mol%, (b) 20 mol%, (c) 30 mol%, (d) 40 mol%, (e) 50 mol%, and (f) 60 mol%.

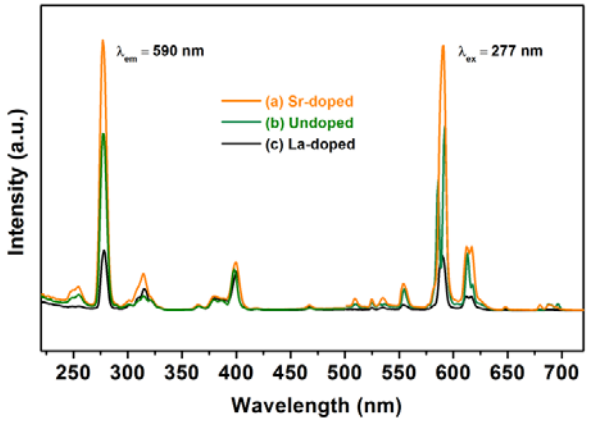

Fig. S6 The excitation (left) and emission (right) spectra of (a) 20 mol% Sr-doped GdF_3:Eu, (b) undoped GdF_3:Eu, and (c) 30 mol% La-doped GdF_3:Eu.

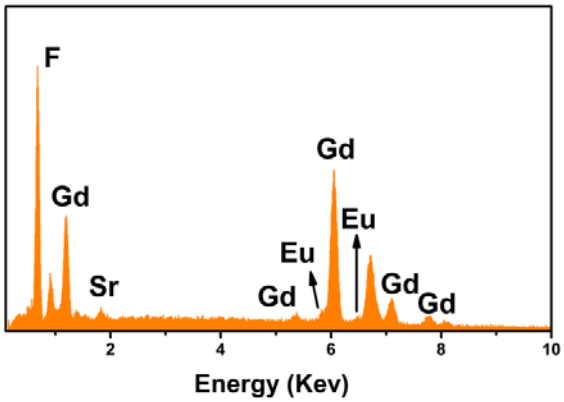

Fig. S7 The EDS spectrum of Sr-doped GdF_3:Eu.

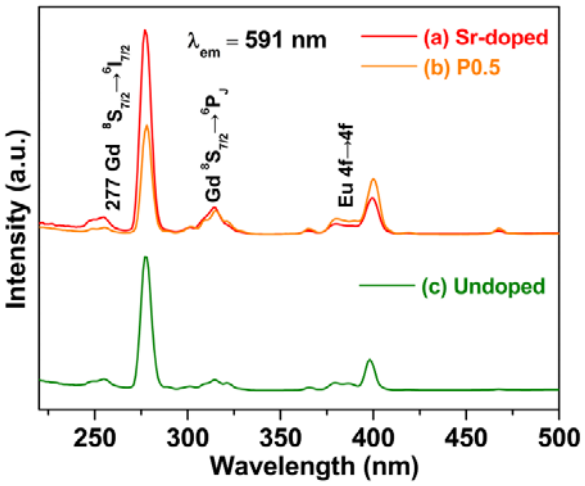

Fig. S8 The excitation spectra of (a) the hexagonal Sr-doped GdF_3:Eu, (b) the hexagonal GdF_3:Eu obtained after reacting for 0.5 h (**P0.5**), and (c) the orthorhombic GdF_3:Eu.