Electronic Supplementary Material (ESI) for RSC Advances

Supporting Information

Dual active luminescence centers from a single-solid composite $SnO_2:Eu^{3+}$/Al-MCM-41: Defect chemistry mediated color tuning for white light emission

Chunfang Du[a,b*], *Huaming Yang*[b*]

[a]College of Chemistry and Chemical Engineering, Inner Mongolia University, Hohhot 010021, China

[b]Research Center for Mineral Materials, School of Minerals Processing and Bioengineering, Central South University, Changsha 410083, China.

* E-mail: xiaodu0210@126.com (C. Du); hmyang@csu.edu.cn (H. Yang)

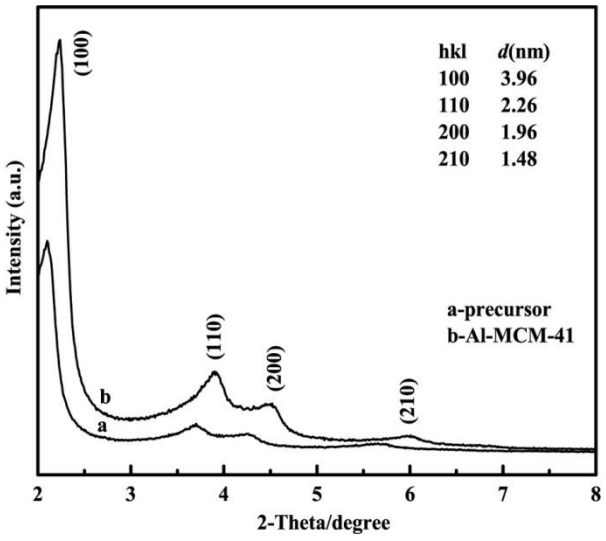

Fig. S1 SAXRD patterns of (a) the precursor and (b) calcined Al-MCM-41.

It is clearly seen that the as-synthesized Al-MCM-41 mesoporous material originated from leached kaolin in this work was as the same well periodically hexagonal ordered as the Al-MCM-41 material synthesized from direct Si and Al sources. All the peaks shifted slightly towards higher angles, and the intensity increased remarkably after calcination in comparison with the precursor, revealing the ordering process induced by silicates polycondensation. According to the formula $a_0=2d_{100}/\sqrt{3}$, the pore structure parameter a_0 decreased from 4.85 nm to 4.57 nm after calcination. The thickness of pore wall t decreased from 2.26 nm to 1.86 nm resulted by the removal of template (CTAB) during calcination, which was calculated according to the following equation: $t= a_0-D_d$, where D_d was estimated as the maximal value of BJH pore size distribution curve obtained from N_2 desorption isotherm.

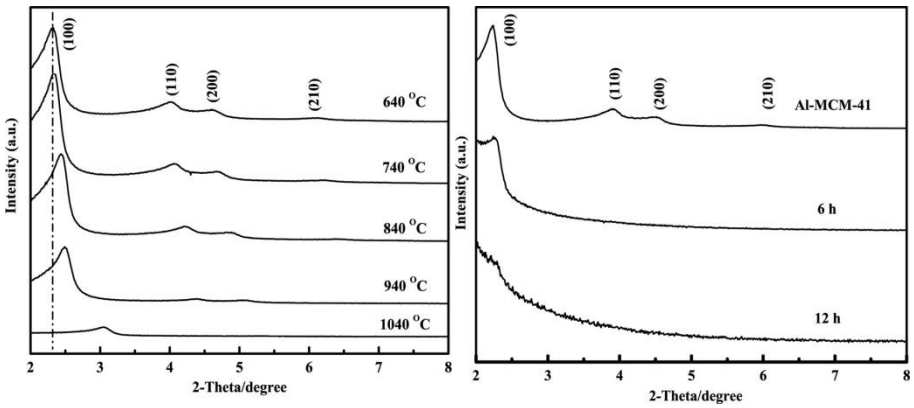

Fig. S2 SAXRD patterns of Al-MCM-41 treated at different thermal temperature and hydrothermal time

The thermal and hydrothermal stability of the mesoporous materials could be evaluated by the thickness of the pore wall. The larger value of t in this work indicated the excellent thermal and hydrothermal stability of the calcined Al-MCM-41.

The SAXRD and N_2 adsorption-desorption measurements suggested that the calcined Al-MCM-41 sample still behaved the well-ordered mesoporous structure and huge surface area of 884 m^2/g after calcination at 940 °C and 907 m^2/g after hydrothermal treatment for 6 h (immersed the Al-MCM-41 powder into the boiled water), which indicated the stable mesostructure and excellent porous properties of the calcined Al-MCM-41 material synthesized with leached kaolin as Si and Al sources.

The structure parameters obtained from SAXRD, N_2 adsorption-desorption isotherms and BJH pore size distribution curves of Al-MCM-41 and SnO_2/Al-MCM-41 composites with different Sn/Si molar ratio are summarized in S3.

Samples	S_{BET} (m^2/g)	V (mL/g)	D (nm)	d_{100} (nm)	a_0 (nm)	t (nm)
Al-MCM-41	1040	1.00	2.70	3.96	4.57	1.86
SnO_2/Al-MCM-41(0.1)	950	0.63	2.52	3.72	4.30	1.78
SnO_2/Al-MCM-41(0.2)	771	0.55	2.32	3.76	4.34	2.02
SnO_2/Al-MCM-41(0.4)	701	0.53	2.34	3.72	4.30	1.96

S_{BET}-BET surface area, V-pore volume, D-BJH pore size, d_{100}-pore spacing, a_0-pore parameter calculated from $a_0=2d_{100}/\sqrt{3}$, t-thickness of pore wall.

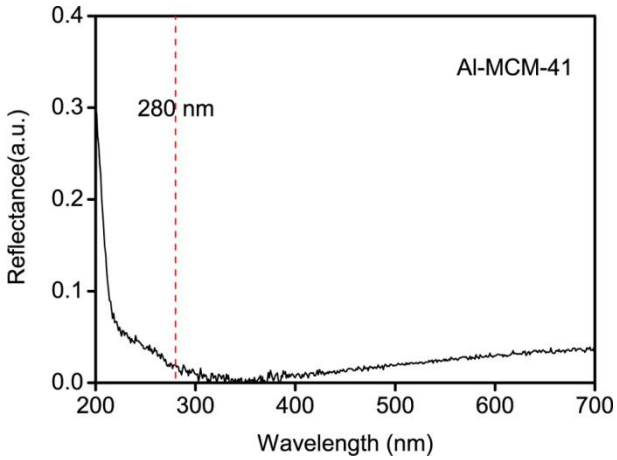

Fig. S4 Optical diffuse reflectance spectrum of Al-MCM-41.

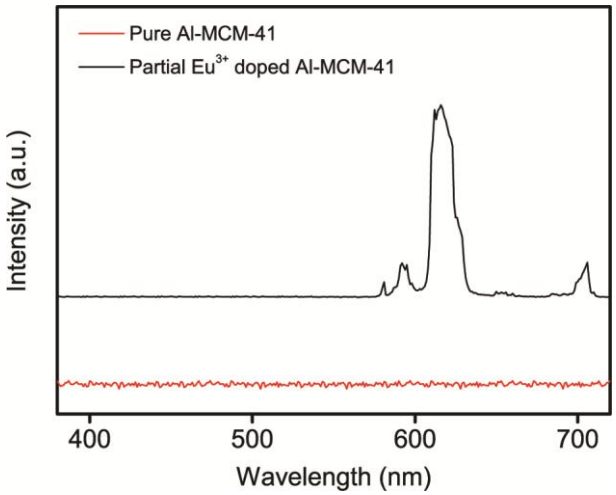

Fig. S5 Emission spectra of pure and partial Eu^{3+} doped Al-MCM-41.

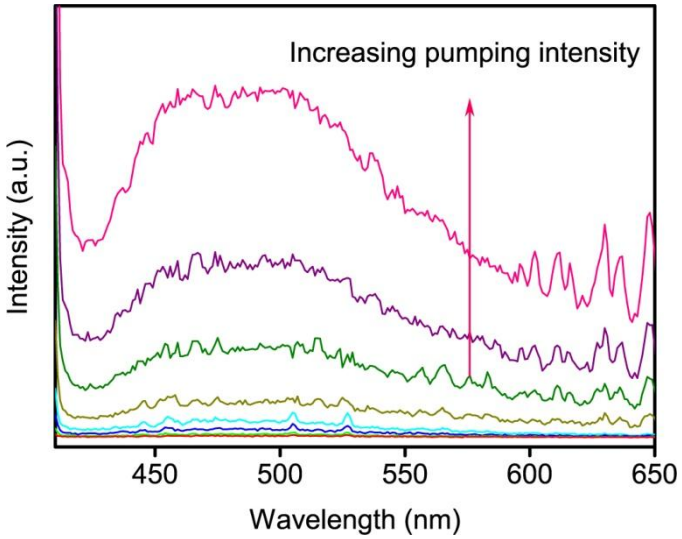

Fig. S6 Emission spectra of SnO_2:(3.50%)Eu^{3+}/Al-MCM-41 composite as a function of pumping intensity when excited by a 405 nm laser.