Electronic Supplementary Information

Improving field emission by constructing CsI-AlN hybrid nanostructures

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SI-1. Setup for CsI evaporation

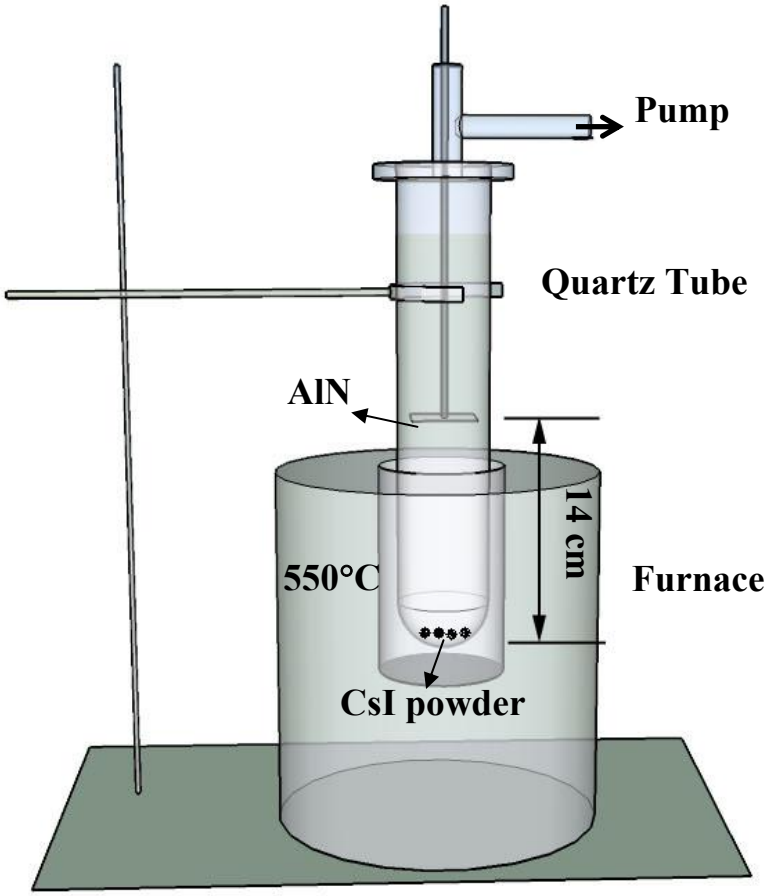

Fig. S1 Setup for CsI evaporation.

SI-2. XRD patterns, EDS spectra and SEM characterization of the samples

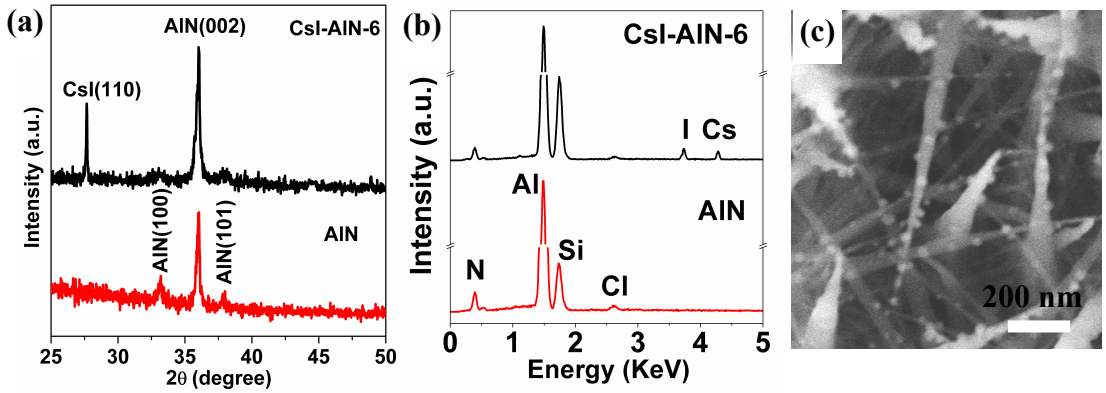

Fig. S2 XRD patterns (a) and EDS spectra (b) of the pristine AlN nanocones and CsI-AlN-6 nanostructures. (c) SEM images of CsI-AlN-6 nanostructures. This area corresponds to the EDS spectrum of CsI-AlN-6 in (b).

It is seen that the pristine nanocones is composed of hexagonal AlN with the preferential growth direction of [001]. EDS spectrum shows the signals of Al and N from AlN, as well as Si signal from the substrate and Cl from surface adsorption. For CsI-AlN-6, many nanoparticles are attached on the surface of the AlN nanocones. The corresponding XRD and EDS results reveal that the nanoparticles are CsI.

SI-3. (HR)TEM characterization on the CsI-AlN-8 sample

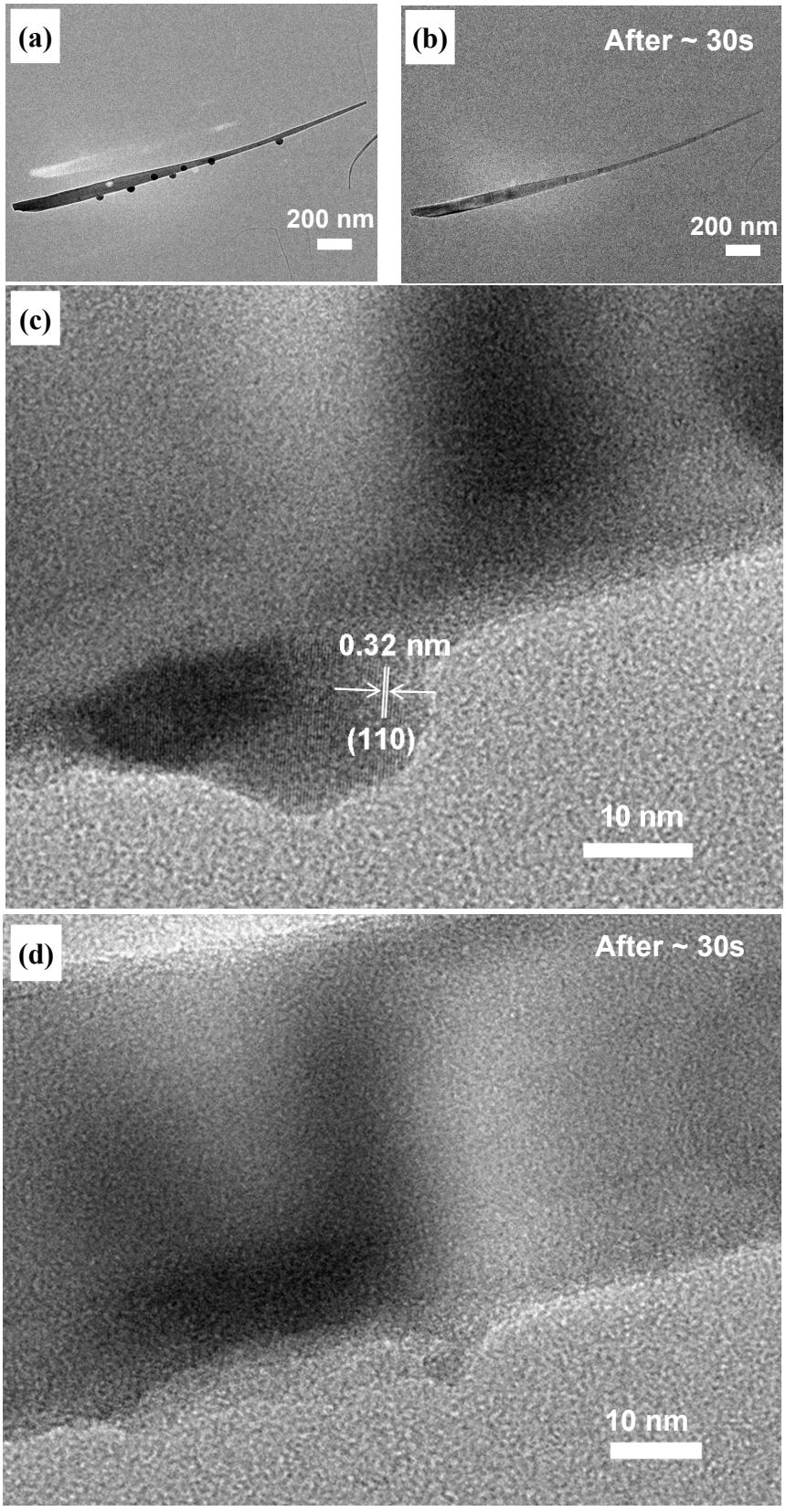

Fig. S3 TEM (a-b) and HRTEM (c-d) images of the CsI-AlN-8 sample. Note: the images in (b) and (d) correspond to the nanostructures after ~30 s (HR)TEM observation. It is seen the CsI nanoparticles were tightly adhered on the surface of the AlN nanocones, which would be evaporated due to the high energy electron beam irradiation.

SI-4. E_{to} and E_{thr} of the patterned and unpatterned CsI-AlN-6 nanostructures

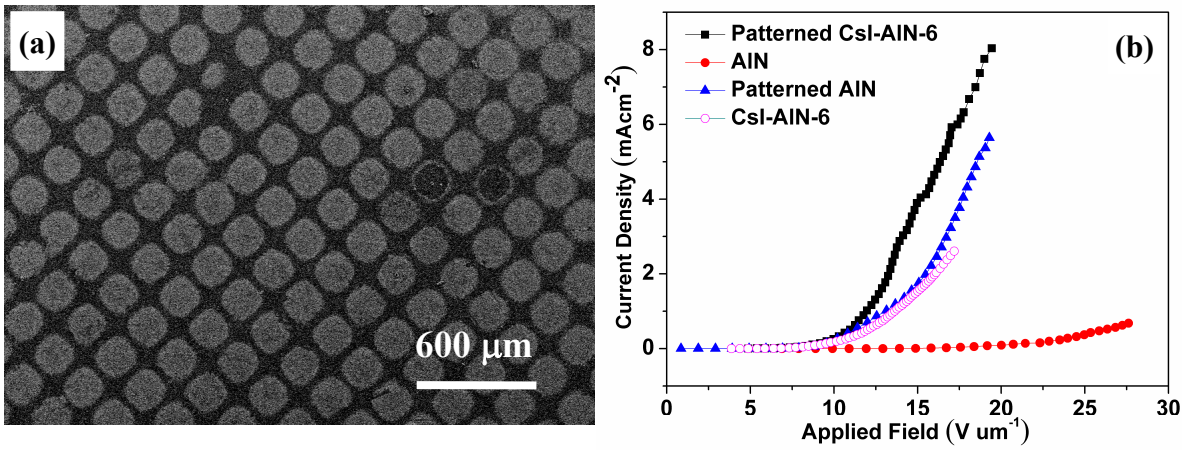

Fig. S4 SEM image (a) and J-E curves (b) of the patterned CsI-AlN-6 nanostructure. Note: the J-E curves of the pristine AlN, patterned AlN, and CsI-AlN-6 samples are also shown in (b) for comparison.

Table S1. E_{to} and E_{thr} of the patterned and unpatterned CsI-AlN-6 nanostructure

Sample	E_{to} (V μm^{-1})	E_{thr} (V μm^{-1})	Note
AlN nanocones	15.2	>30	this work
Patterned AlN nanocones	7.7	13.1	Ref. 3 of this paper
CsI-AlN-6	7.0	13.6	this work
Patterned CsI-AlN-6	6.6	11.8	this work*

*The field emission property of the patterned CsI-AlN-6 nanostructure is better than the unpatterned one due to the decreased screening effect.

SI-5. Comparison of E_{to} and E_{thr} between CsI-AlN-6 and some other nanostructures

Table S2. E_{to} and E_{thr} of some nanostructures

Sample	E_{to} (V μm^{-1})	E_{thr} (V μm^{-1})	Note
WO_3	1.8	3.3	Ref. 31 of this paper
CdS	3.7	9.3	Ref. 32 of this paper
ZnS	3.69	/	Ref. 33 of this paper
Patterned AlN nanocones	4.8/7.7	11.2/13.1	Ref. 3 of this paper
Si-doped AlN	1.8	4.6 at 10 mA cm^{-2}	Ref. 17 of this paper
CsI-AlN-6	7.0	13.6	this work

E_{to} and E_{thr} correspond to the electric field to generate an emission current density of 10 μA cm^{-2} and 1 mA cm^{-2}, respectively.

SI-6. XPS spectra of the hybrid samples before and after field emission measurement

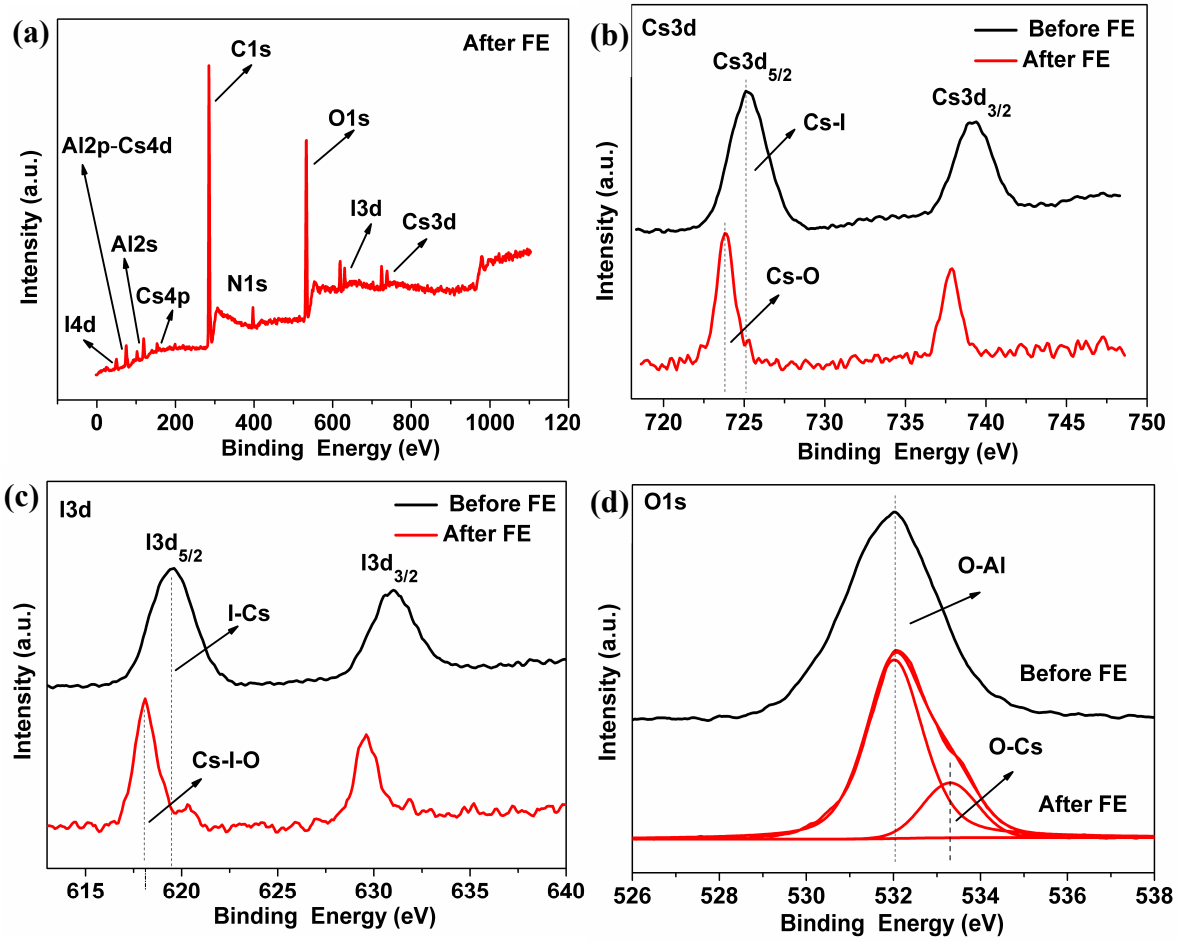

Fig. S5 XPS spectra of the CsI-AlN-6 hybrid samples before and after field emission (FE) measurement. (a) survey; (b) Cs3d; (c) I3d; (d) O1s.

Note: The binding energies for the marked species are about 723.8 and 725.1 eV for Cs-O[1] and Cs-I in (b), 619.5 and 618.2 eV for I-Cs and Cs-I-O[2,3] in (c), 532.0 and 533.3 eV for O-Al and O-Cs1 in (d). It is noticed that both Cs3d and I3d signals shift to the low binding energy side for about 1.3 eV after FE.

Reference

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