## **Supplementary material**

CsPbBr<sub>3</sub> Microarrays with Tunable Periodicity, Optoelectronic and Field Emission Properties Using Self-Assembled Polystyrene Template and Co-Evaporation Method

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Figure S1. Morphologies of 80 nm compact CsPbBr<sub>3</sub> films on bare Si. (a) SEM image. (b) AFM  $(5 \times 5 \ \mu m)$  image.



**Figure S2.** SEM cross-section images of 80 nm (a) compact CsPbBr<sub>3</sub> films and microarrays with tunable periodicity (b: 1µm, c: 350 nm, d: 150 nm).



**Figure S3.** SEM-EDS spectrum of CsPbBr<sub>3</sub> microarrays on self-assembled PS nanospheres with diameters of 150 nm.



**Figure S4.** XPS spectra for (a) Cs 3d, (b) Pb 4f and (c) Br 3d of CsPbBr<sub>3</sub> microarray on self-assembled PS nanospheres with diameters of 150 nm, respectively.



**Figure S5.** Surface potential distribution and cross-section profiles of (a) 80 nm compact CsPbBr<sub>3</sub> films on bare Si, and (b) CsPbBr<sub>3</sub> microarrays on self-assembled PS nanospheres (150 nm). The insets show the corresponding AFM images ( $5 \times 5 \mu m$ ).



Figure S6. XRD patterns of compact CsPbBr<sub>3</sub> films and microarrays with tunable periodicity.



**Figure S7.** (a) Absorption spectra and (b) corresponding plot of the  $(\alpha h \upsilon)^2$  versus h $\upsilon$  of 80 nm compact CsPbBr<sub>3</sub> films and microarrays with tunable periodicity.



**Figure S8.** Absorption spectra of (a) the PS template with the periodicity of 1  $\mu$ m and (b) 500 nm compact CsPbBr<sub>3</sub> films and microarrays with tunable periodicity.



Figure S9. Schematic structure of CsPbBr3 microarrays based field emission device.



Figure S10. J-E curve of self-assembled PS nanospheres (150 nm) on Si.



**Figure S11.** UPS spectra of compact CsPbBr<sub>3</sub> films at the low (a) kinetic energy and (b) binding energy region, respectively.



**Figure S12.** (a) *J-E* curve and (b) corresponding F-N plots of 80 nm compact CsPbBr<sub>3</sub> films and microarrays on self-assembled PS nanospheres (150 nm)/graphite.



**Figure S13.** SEM images of self-assembled PS nanospheres on graphite (a) - (b) before and (c) after the formation of CsPbBr<sub>3</sub> microarrays.