Electronic Supplementary Material (ESI) for Journal of Materials Chemistry C.

Supporting Information

Significant field emission enhancement in ultrathin nano-thorn covered NiO nano-petals

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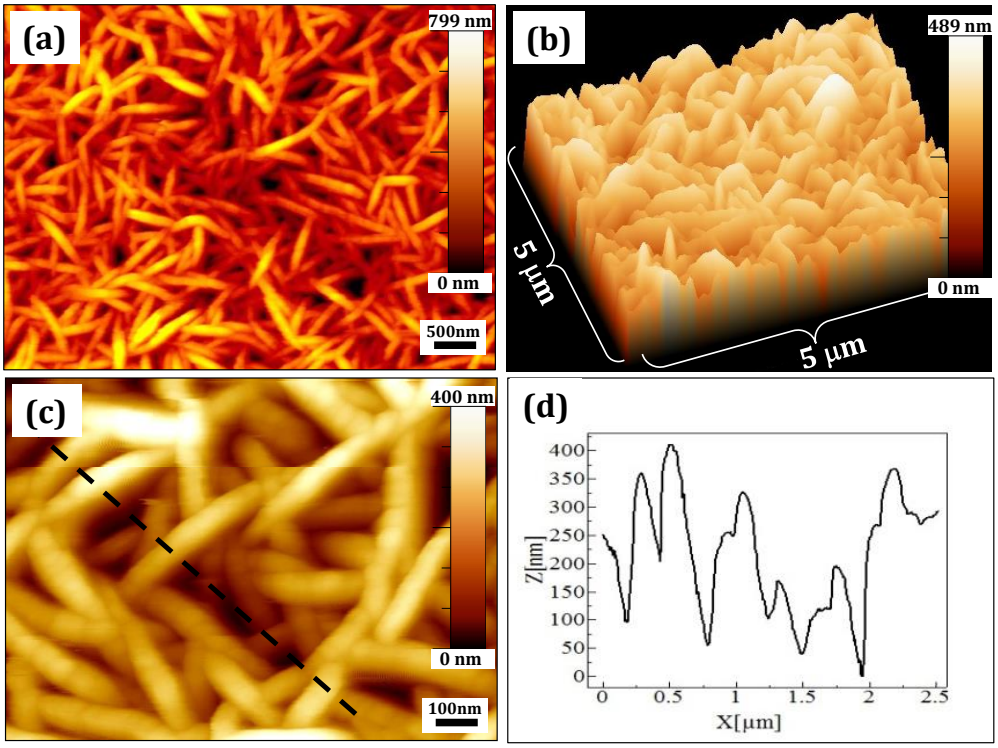

Figure S1: *(a, b) AFM images of NiO-NPs grown on FTO substrate in 2D and 3D view. (c) high resolution image with(d) line profiling.*

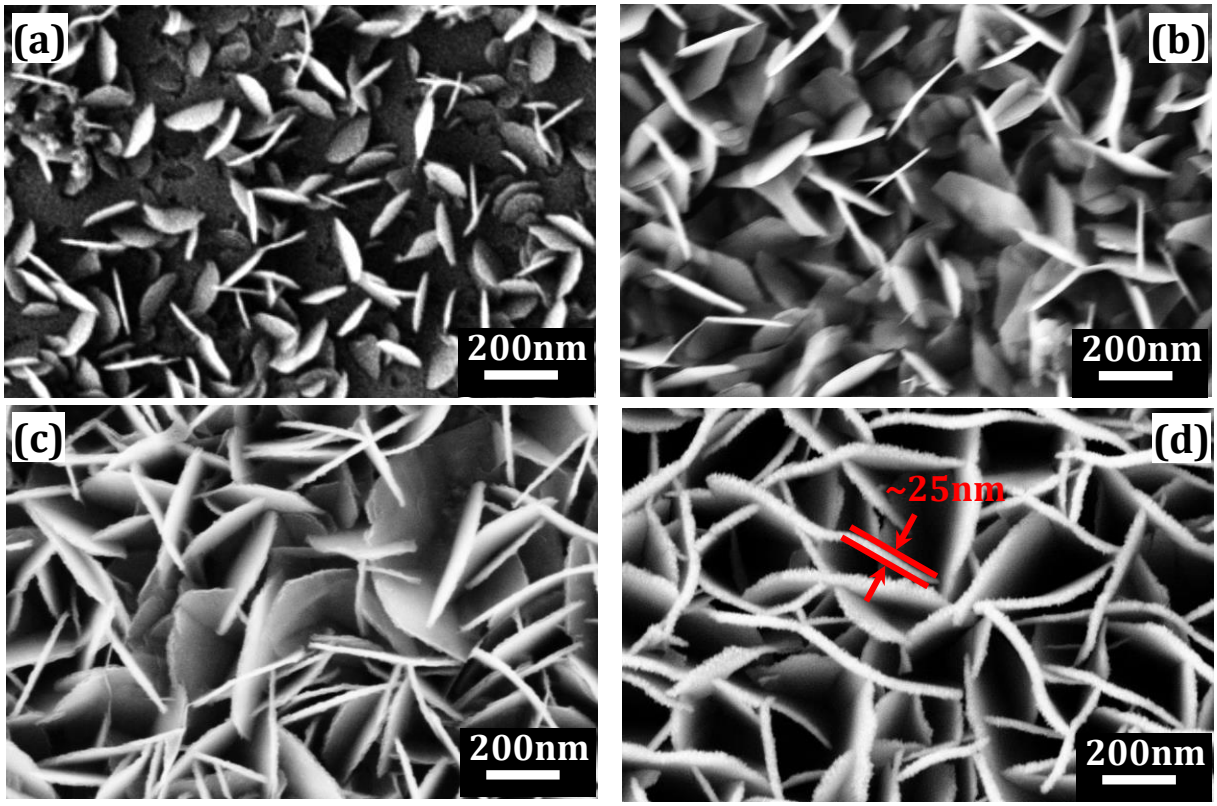

Figure S2: Surface morphologies of NiO nanopetals grown by hydrothermal process with deposition time of (a) 2 hrs. (b) 3 hrs. (c) 4 hrs. and (d) 5 hrs.

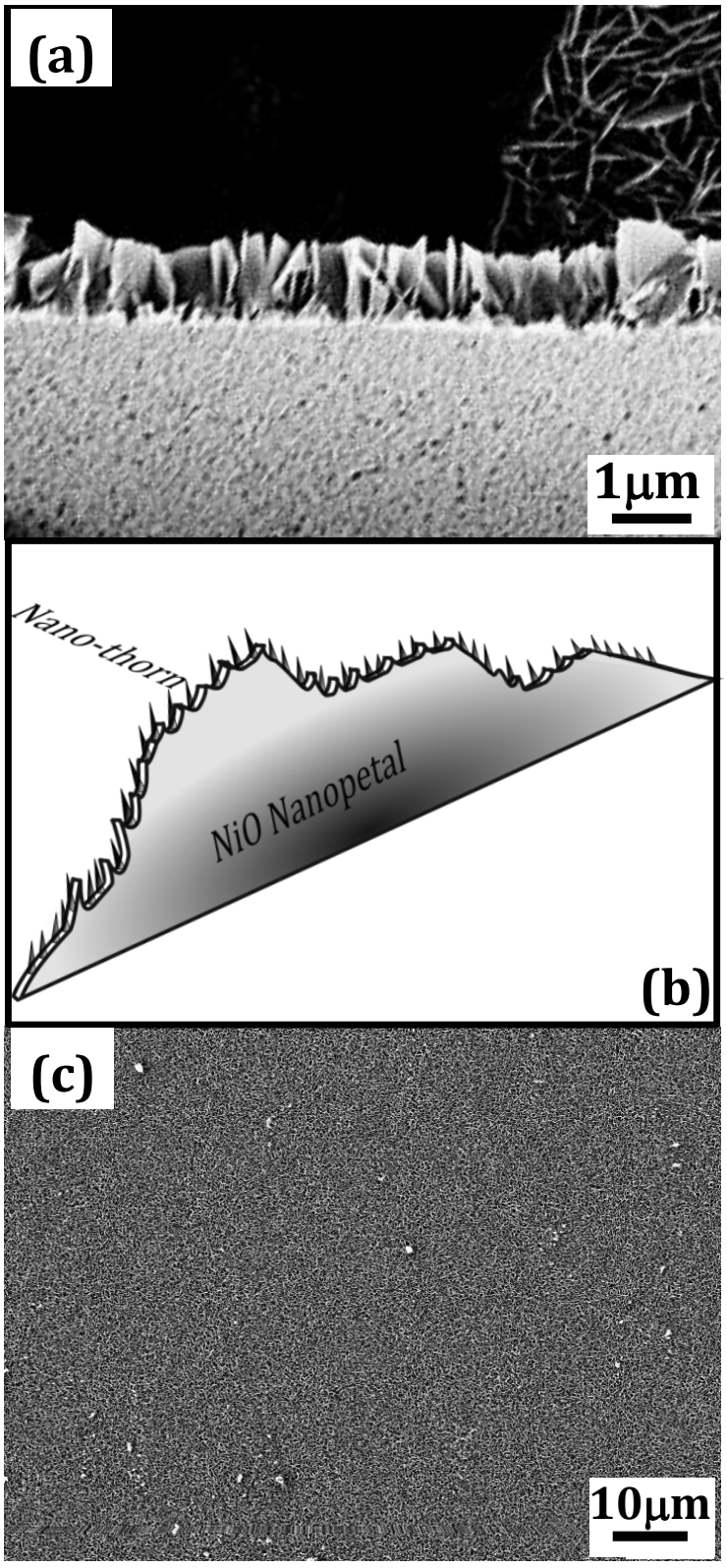

Figure S3: *(a) Cross-sectional SEM image of NiO-NPs (b) schematic view of single nanopetal to show sharp needles like edges on the top (c) broad area view of the same.*

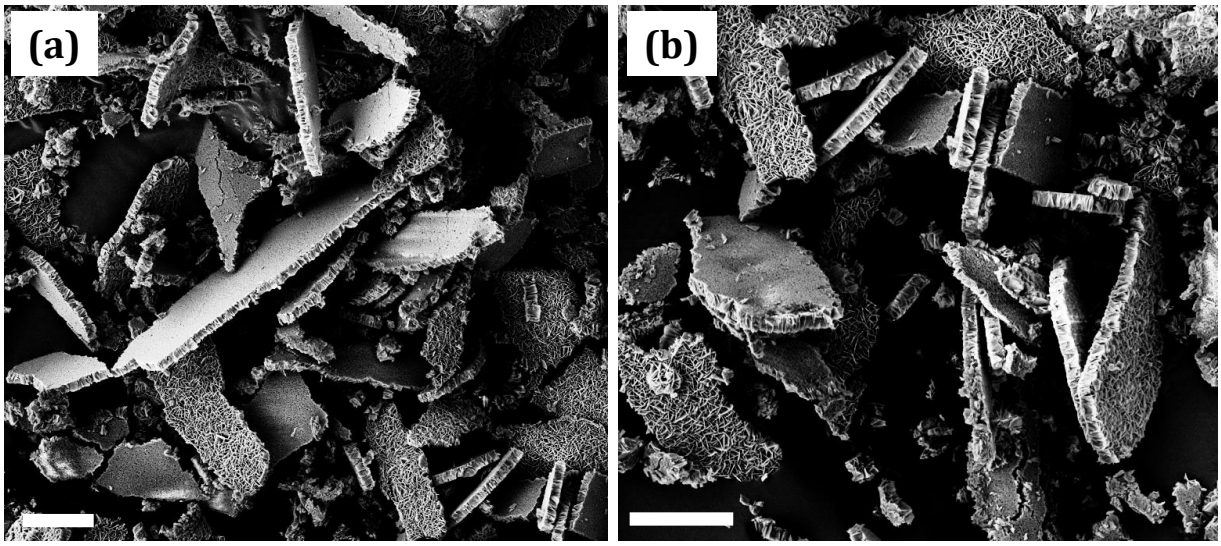

Figure S4: *(a, b) SEM image of the NiO-NPs film scratch-off from the FTO substrate to show the alignment and uniformity of the film. Scale bar in the images correspond to 2 μm*

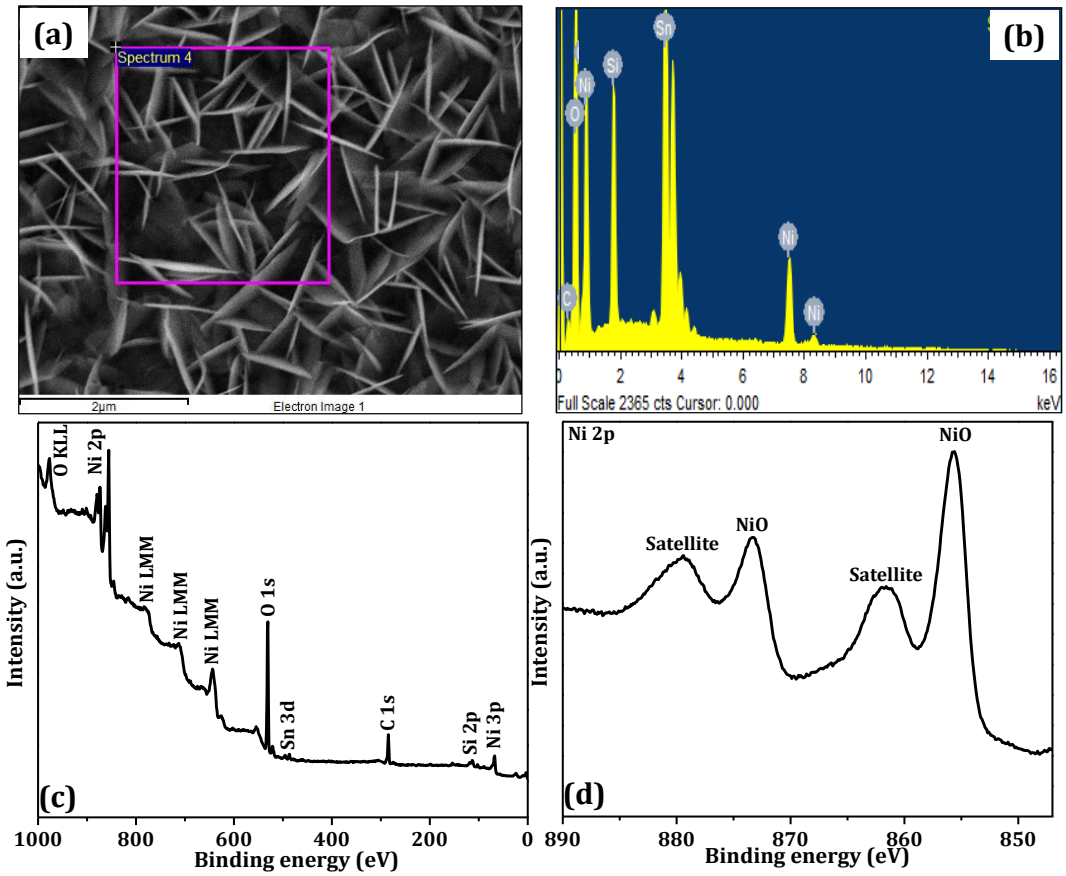

Figure S5: *(a) SEM image of NiO-NPs with their corresponding (b) EDX spectrum and (c) XPS survey scan and (d) Ni-2P elemental scan of the same recorded at 10 degree. Experimental details about XPS measurements have been given below.*

XPS measurements

The x-ray photoelectron spectroscopy (XPS) measurements as shown in Figures S5 (c) and (d) have been performed using Specs (Germany) XPS system. The said XPS system is equipped with 150 mm hemi-spherical analyzer and with Al $K\alpha$ (1486.6 eV) X-ray source. Prior to XPS measurements the surface of the sample was properly cleaned using in built argon ion sputtering gun. All measurements were performed at room temperature and at working pressure of 5×10^{-9} Torr, the pass energy was kept at 20 eV and the dwell period was 0.1 Seconds. The energy resolution of the XPS system is 0.85 eV. Ten number of scans were recorded and averaged to obtain the final spectra. As the prepared flakes NiO samples are approximately perpendicular to the plane of the substrate hence the XPS data were collected at two different angles of 10 and 70 degrees to optimize the signal. The spectrum in Figure S5(d) are similar to the one reported by chen et al[1]. which is suggestive of presence of NiO in our sample. The peak near 855 eV indicates that nickel in the form of $Ni(OH)_2$ might also be present[2]

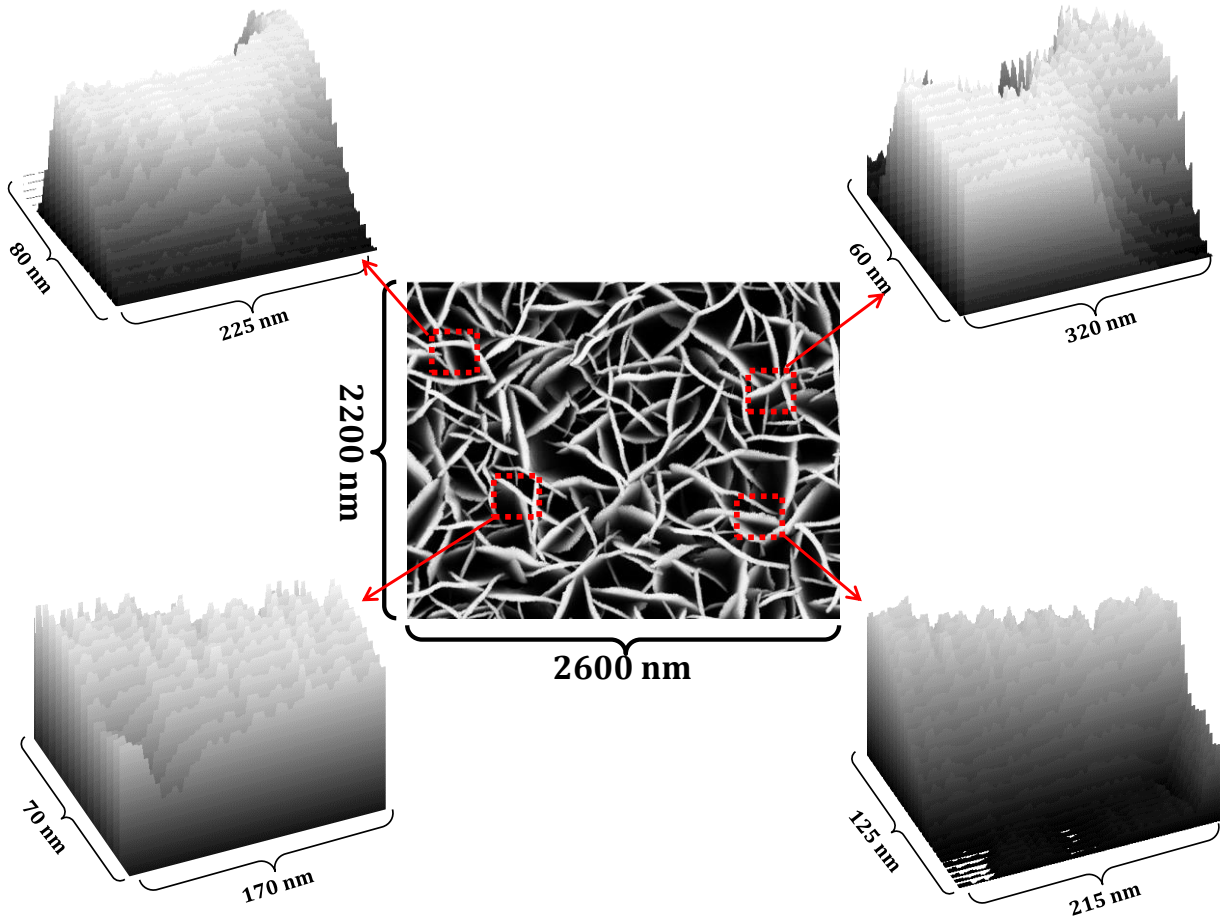

Figure S6: *Morphological analysis of nanopetals, for fetching nanothorns on the petal like structures, using line scanning by* ***ImageJ*** *software.*

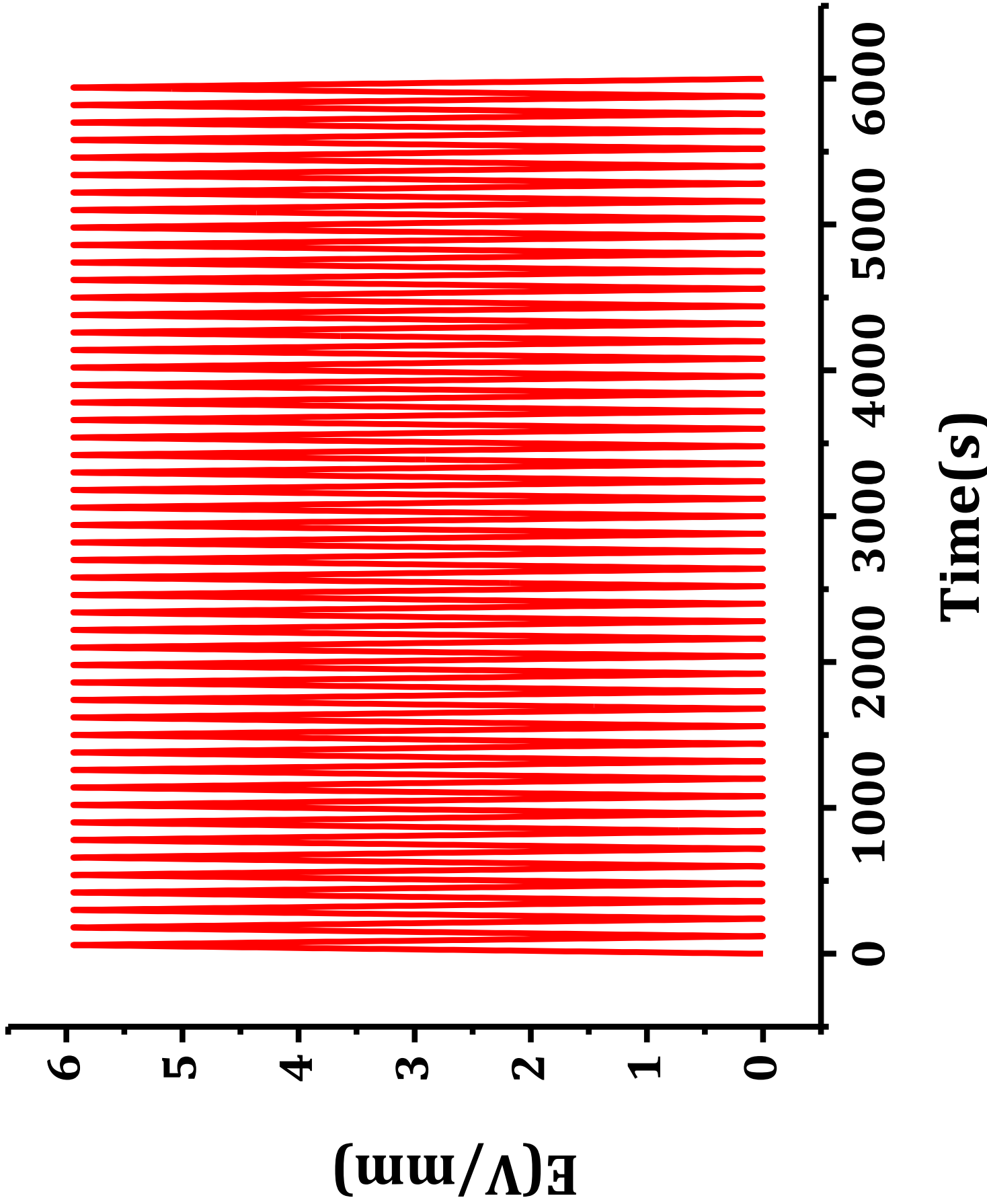

Figure S7: *Electric field cycles (Figure 5a inset, main text).*

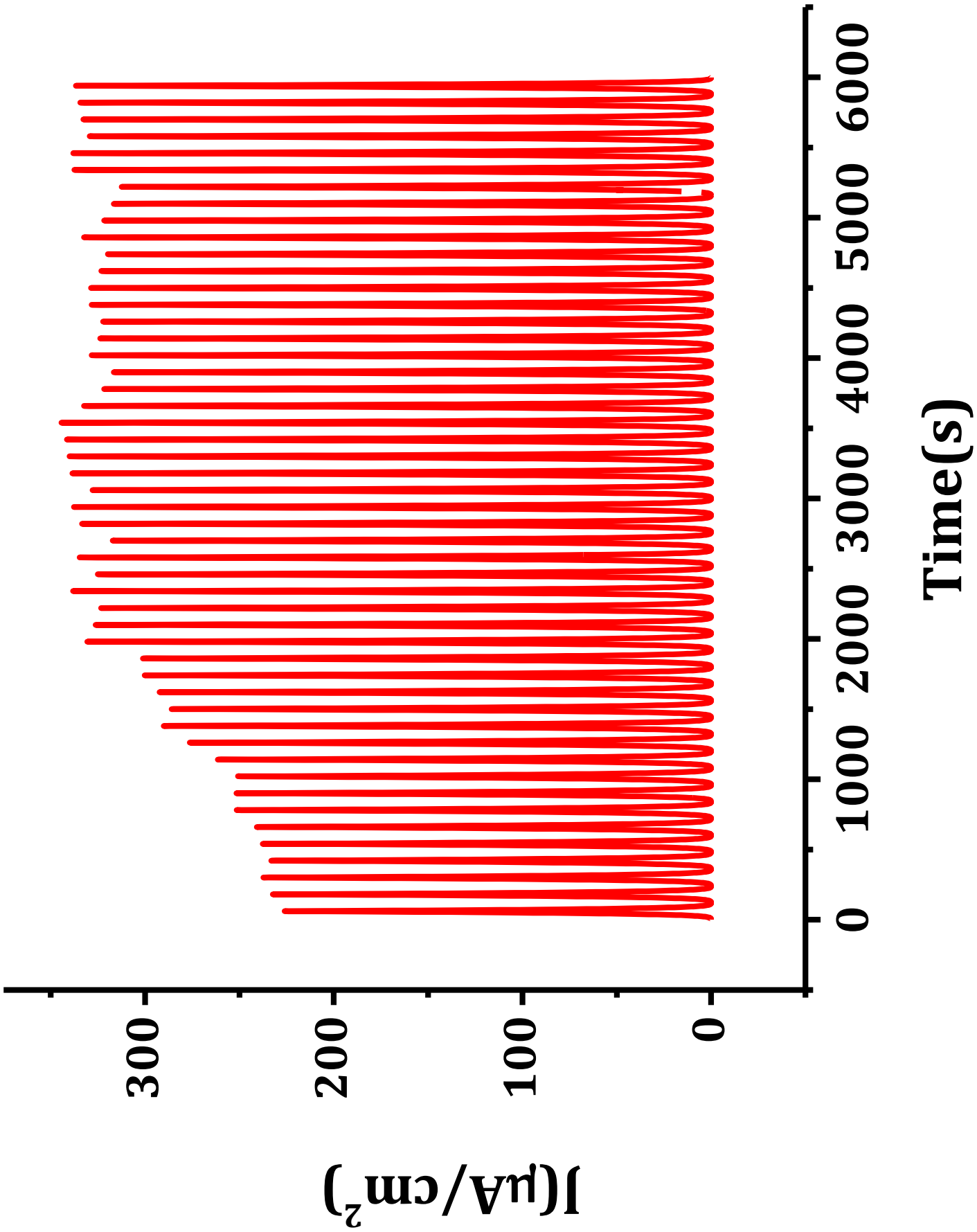

Figure S8: *Emission current cycles (Figure 5b inset, main text).*

References

1 Y. Chen, Y. Wang, P. Sun, P. Yang, L. Du and W. Mai, *J. Mater. Chem. A*, 2015, **3**, 20614–20618.
2 M. C. Biesinger, B. P. Payne, L. W. M. Lau, A. Gerson and R. S. C. Smart, *Surf. Interface Anal.*, 2009, **41**, 324–332.