

Supplementary materials

**Dendrite suppression by anode polishing in zinc-ion batteries**

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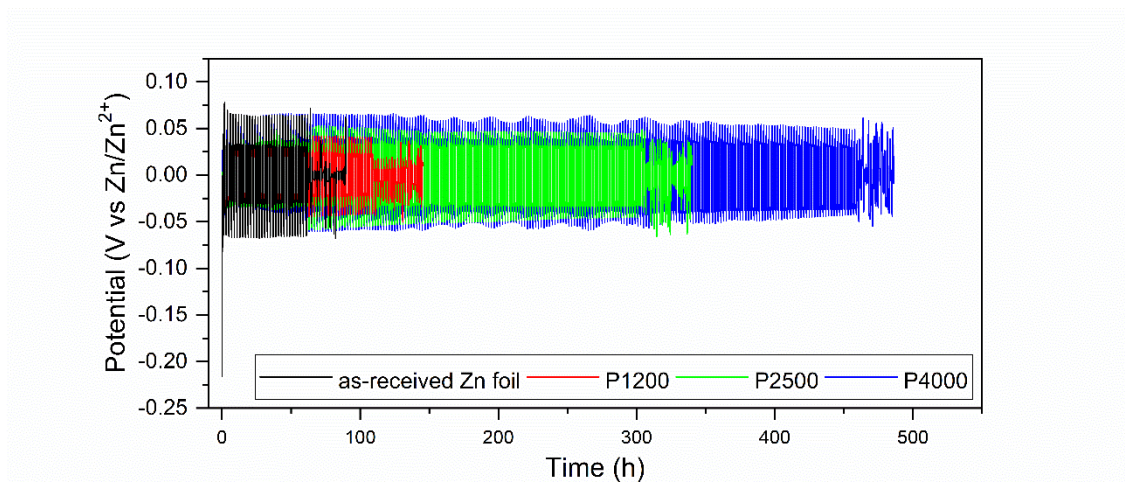


Fig. S1. The cycle life of another group of four symmetric cells.

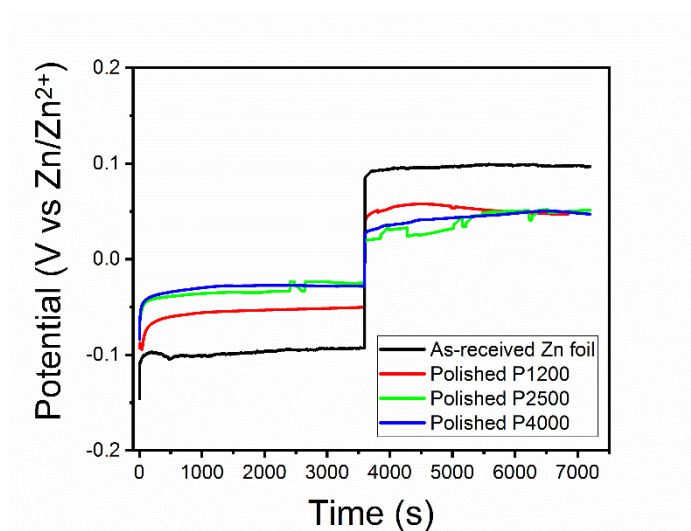


Fig. S2. The potential profiles of the four electrochemical symmetric cells during the first plating and stripping, as the *in situ* EC-AFM being taken. Fluctuations are caused by tip movements during withdrawal/reengagement, necessary for continued image capture.

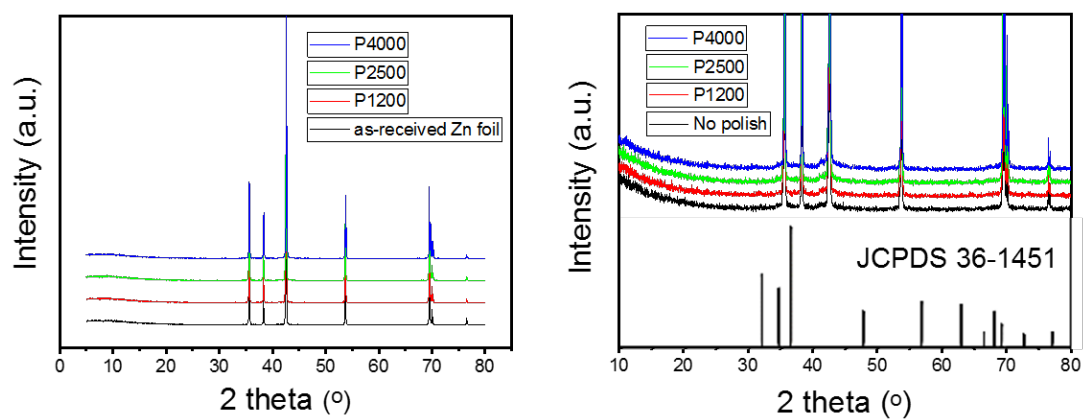


Fig. S3. XRD patterns of the four Zn foils (as-received and three polished), compared to the standard ZnO pattern (JCPDS 36-1451). No ZnO peaks are detected.

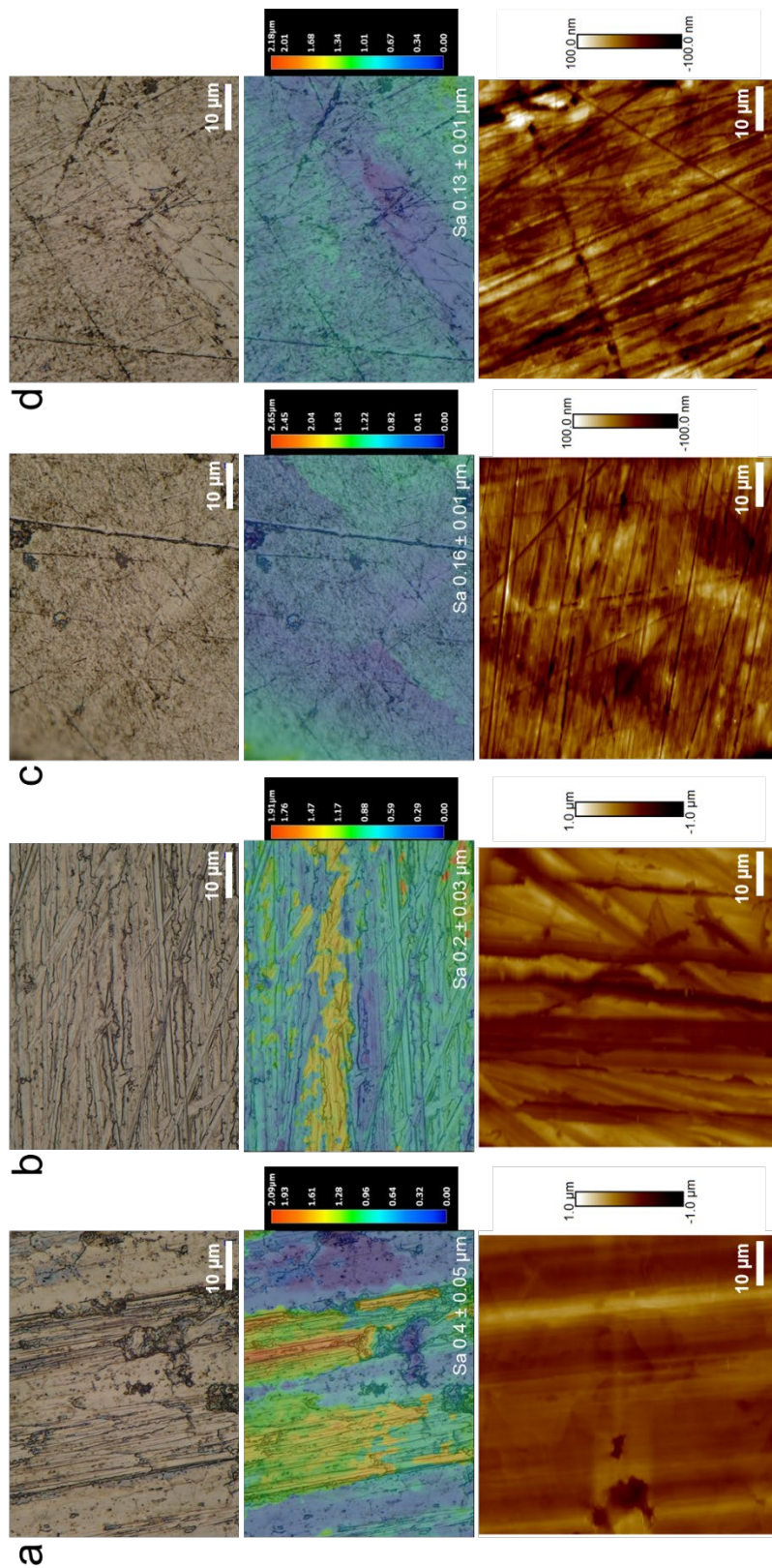


Fig. S4. The initial OM and AFM images of (a) as-received Zn foil, (b-d) polished with grind paper P1200, P2500, and P4000. The Sa value of the images are shown in the 3D OM images.

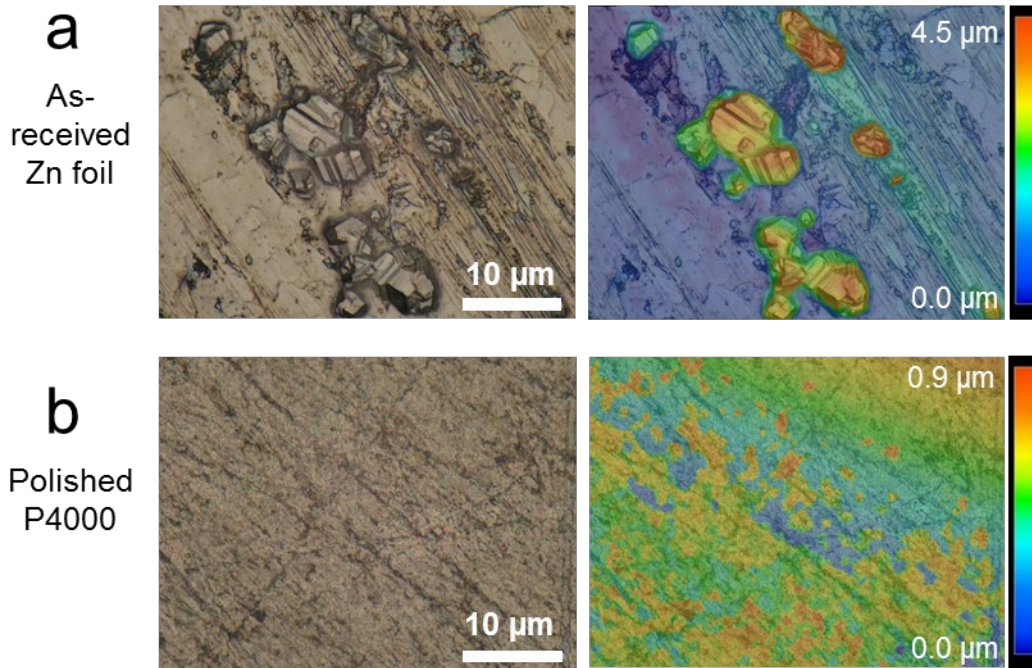
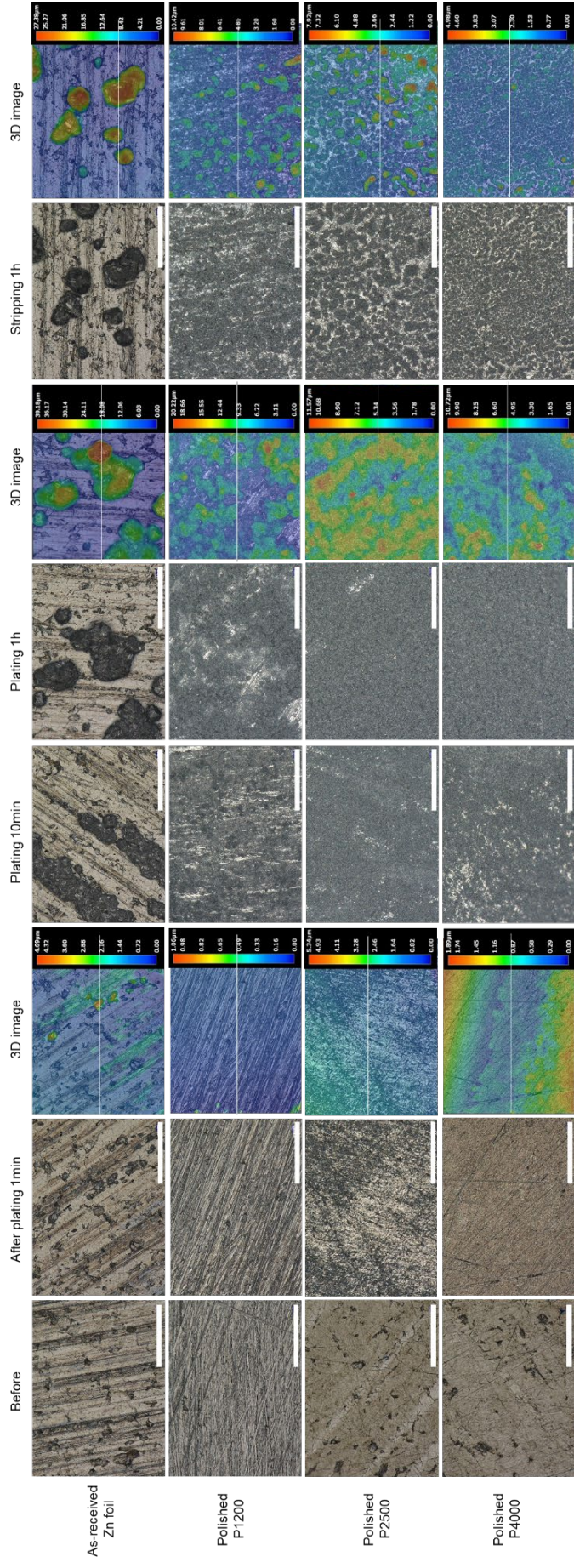


Fig. S5. Enlarged images (4000 times) of Figure 2b and f, which gives more accurate Sa values. The maximum height of the polished Zn after 1 minute of plating, is only 0.9  $\mu\text{m}$  and the Sa value is 0.11  $\mu\text{m}$ . By contrast, for as-received Zn, bulk Zn crystallites are already formed, with a maximum height of 4.5  $\mu\text{m}$  and an Sa of 0.69  $\mu\text{m}$ .





As-received Zn foil

Polished P1200

Polished P2500

Polished P4000

Fig. S6. The 1000 times magnification OM images of before operation, plating for 1 min, 10 min, 1 h and stripping for 1 h (in columns) of the samples of as-received Zn foil, polished by grind paper of P1200, P2500, P4000 (in rows). 3D images of plating for 1 min, 1 h and stripping for 1 h are given with the height scales. Scale bars are 100  $\mu\text{m}$ .

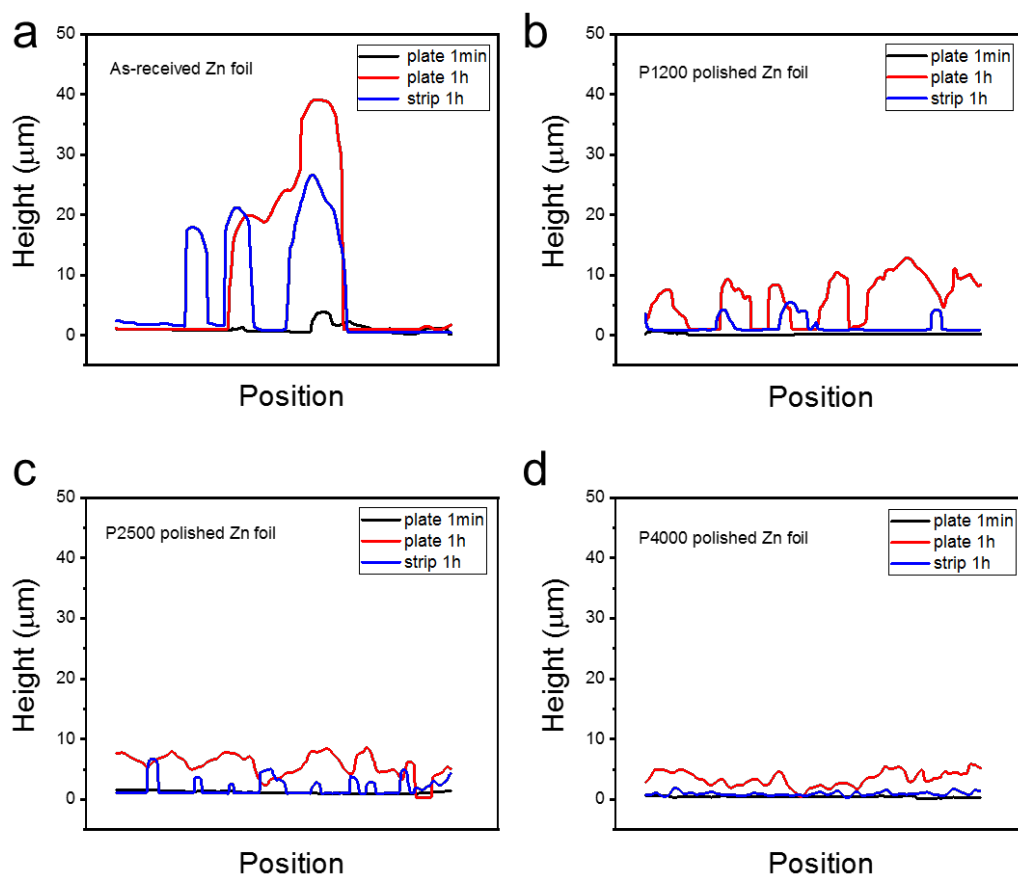


Fig. S7. The height profile along the white lines in the OM images of 1000 times magnification after plating for 1 min, 1 h and stripping for 1 h for the four samples (a) as-received Zn foil, (b) P1200 polished (c) P2500 polished and (d) P4000 polished.

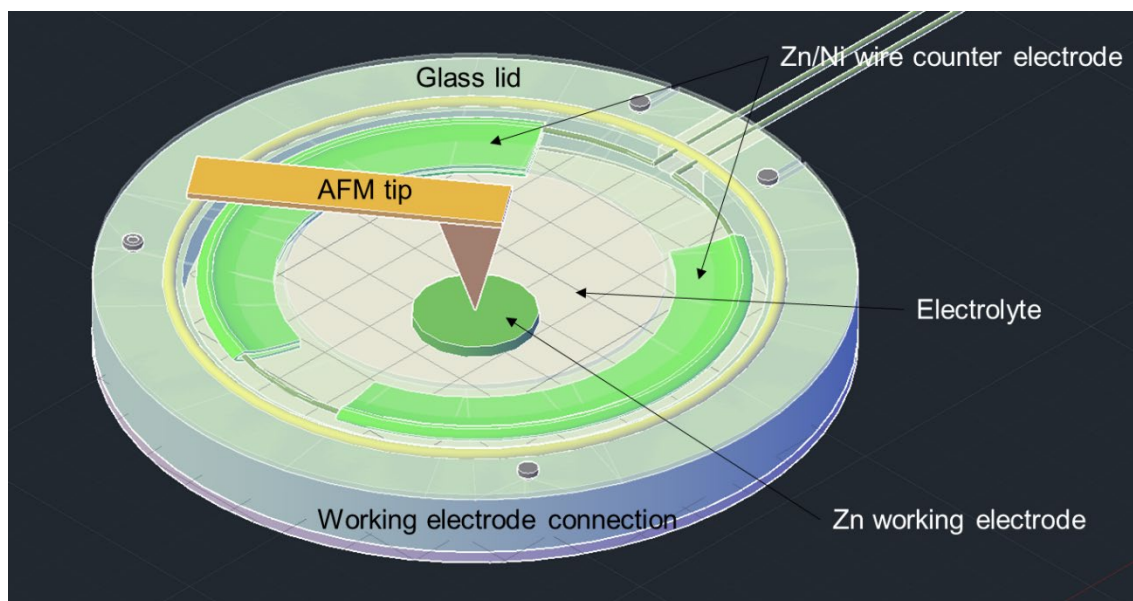


Fig. S8. The configuration of the electrochemical cell used in *ex situ* OM and *in situ* EC-AFM.

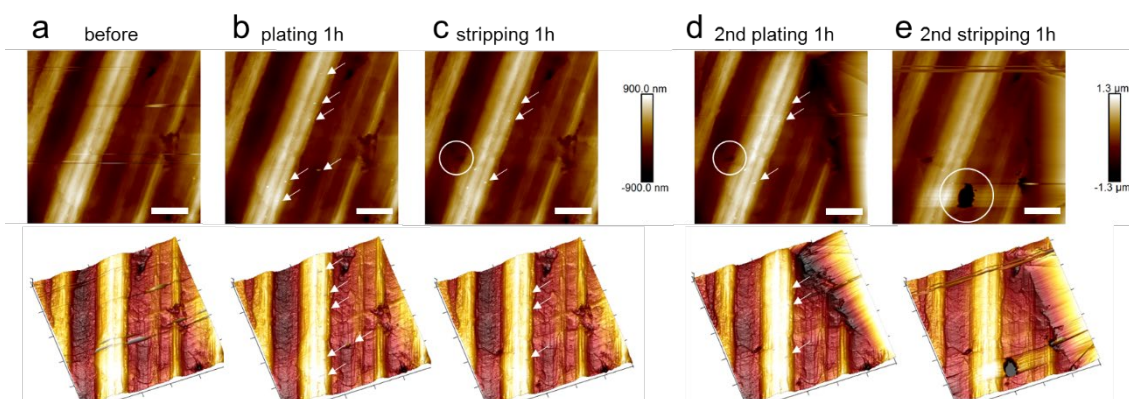


Fig. S9. *In situ* EC-AFM images of as-received Zn foil electrode, (a) before operation, after (b) plating for 1 h, (c) stripping for 1 h, (d) second plating for 1 h, (e) second stripping for 1 h in a  $50 \times 50 \mu\text{m}^2$  area. Scale bars are  $10 \mu\text{m}$ . After the first hour plating, little change can be observed, only some small particles appear on the back the arch lines (one appears at the trench), as indicated by the arrows. These small particles ( $\sim 1 \mu\text{m}$  diameter) are considered to be the failed nucleation sites that did not induce the accumulation of crystal growth, some of which still existed in the following process. After the first stripping, the particles at the trench disappeared, and a pit appeared, as indicated by the circle. Since the second plating, the images are disturbed by potentially arising large particle from adjacent area



(right side), displaying with increased height range. Except from the remained features (small particles and pits), a large pit ( $\sim 7 \times 9 \mu\text{m}^2$  area) appeared after the second stripping, as indicated by the large circle. 3D images are provided accordingly, for a better observation of the changes. These images suggest the uneven plating and stripping of Zn on the as-received Zn foil electrode.

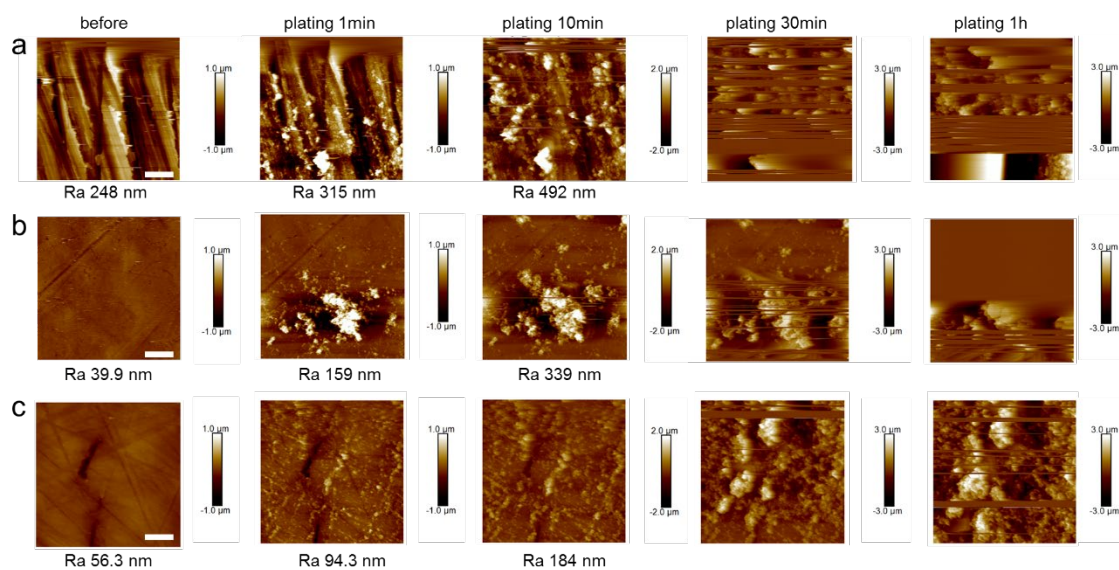


Fig. S10. *In situ* EC-AFM images during the whole 1 h plating of polished Zn foil electrodes at different stages: polished with grind papers of (a) P1200, (b) P2500, (c) P4000. Scale bars are 10  $\mu\text{m}$ .