

**Supporting Information for:**

**Photoelectrochemical water splitting from ordered  
honeycomb hematite electrode stabilized by alumina  
shielding**

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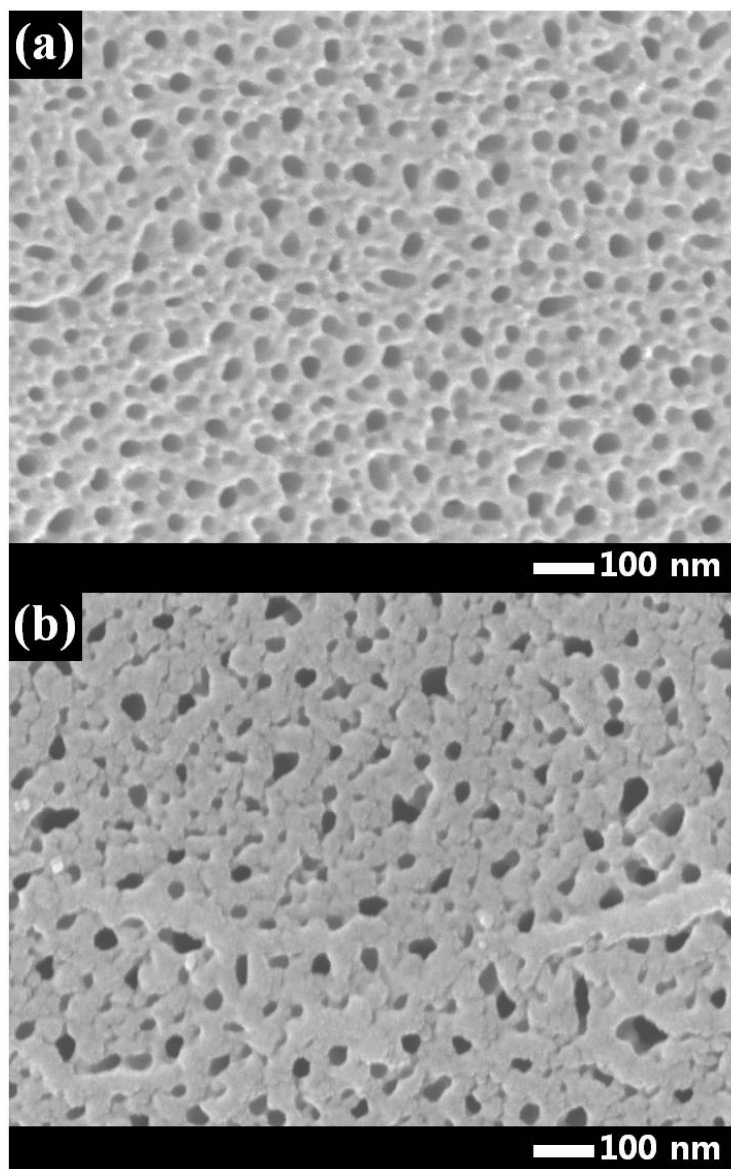
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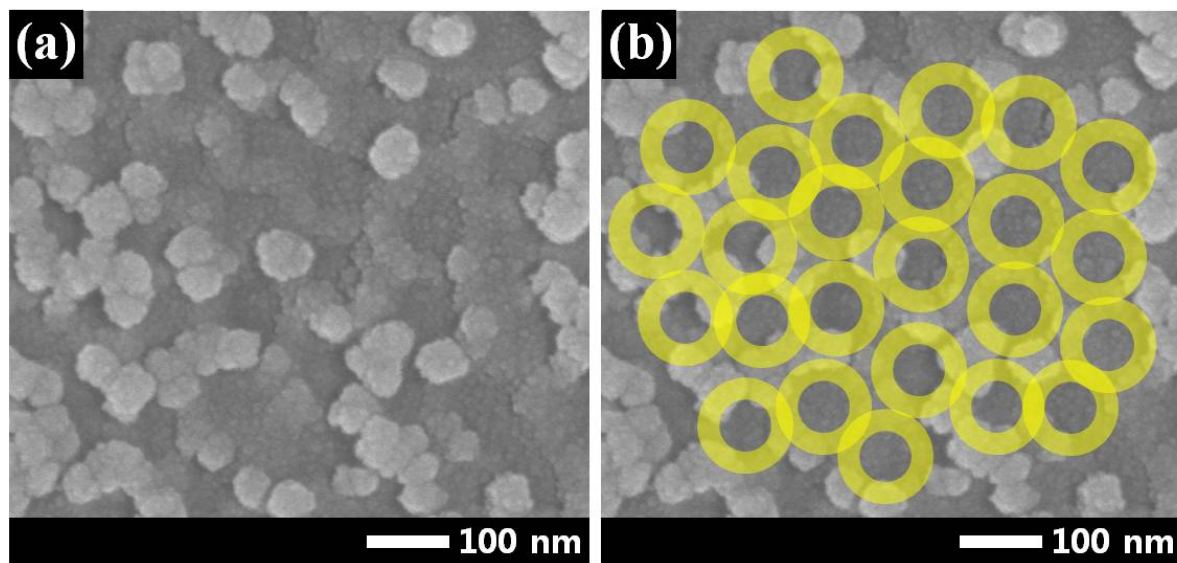
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## SEM images of single step anodized hematite



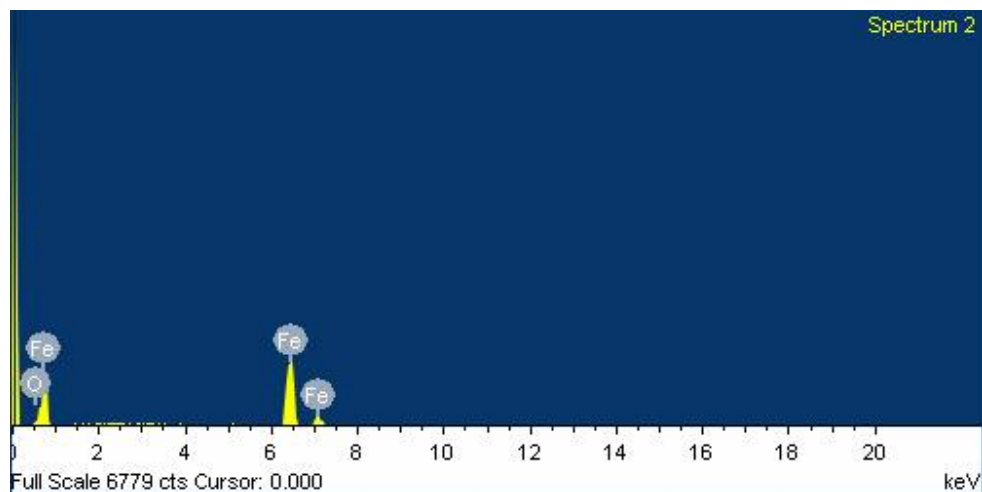
**Fig. S1** SEM image (top view) of 1 step anodized iron oxide film before annealing (a) and after annealing with alumina shielding and  $\text{Al}_2\text{O}_3$  removal (b).

The uniformity of the morphology is poor due to the randomness of pore formation induced by homogeneous electric field on flat Fe metal surface.



**Fig. S2** SEM image of textured metal surface after 1<sup>st</sup> anodic oxide layer detaching (a). Yellow circles show textured patterns of the Fe metal surface on the same image of (a).

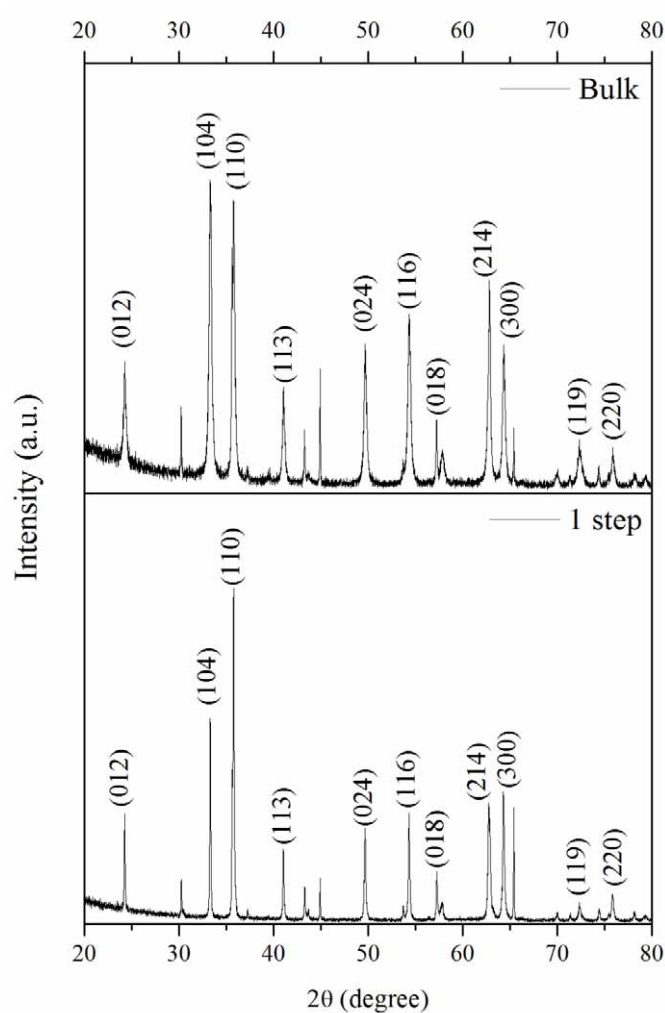
At the edge of the circle patterns, there exist residual oxide species that remained after 1<sup>st</sup> anodized layer removal. However, those oxides do not affect to morphology of the 2<sup>nd</sup> anodic hematite surface since the selective dissolution of iron oxide is occurred at the bottom of the well-like patterns shown in **figure S2** as hollow area of yellow circles.



**Fig. S3** SEM-EDS spectrum of 2 step anodic hematite annealed with alumina shielding after  $\text{Al}_2\text{O}_3$  removal (shown in **Fig. 2(c)**).

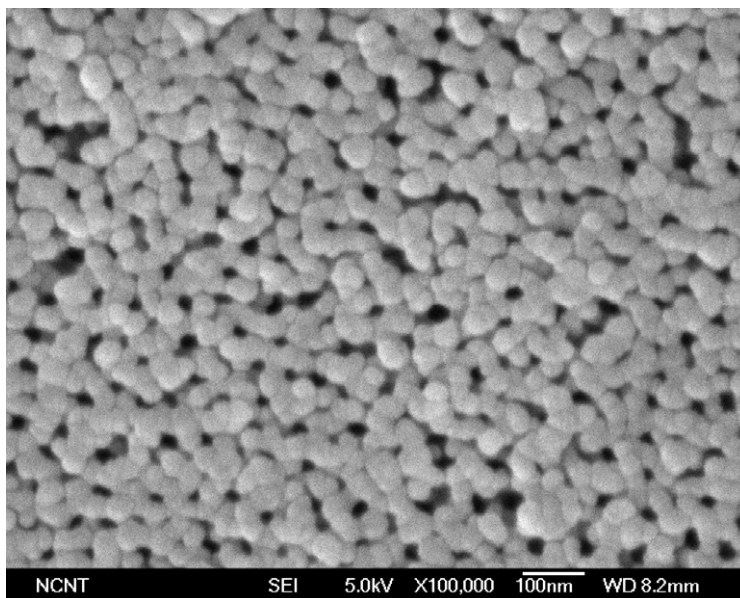
By this observation, we could know that there was no aluminum species residue on the anodic hematite film after alumina dissolution in 1M sodium hydroxide solution. This was also supported by inductively coupled plasma (ICP) mass spectroscopy with which no aluminum was found as mentioned before in communication.

## XRD patterns



**Fig. S4** X-ray diffraction patterns of bulk (annealed without alumina shielding) and 1 step anodized (annealed with alumina shielding) hematite films. All peaks marked with indices are matched with hematite reference (JCPDS 86-0550). Peaks at  $2\theta = 45$  and  $66$  indicate Fe metal substrate. These *high-resolution* XRD patterns were obtained at the PAL synchrotron 8C2 (High-resolution powder diffraction, HRPD) beamline.

## SEM images of 2 step anodized hematite with alumina layer



**Fig. S5** SEM image of 2 step anodized iron oxide film shielded with alumina layer after annealing at 550 °C for 2 hr. (Before alumina removal)