

Electronic Supplementary Information (ESI)

## **Engineering 3D-printed carbon structures with atomic layer deposition coatings as photoelectrocatalysts for water splitting**

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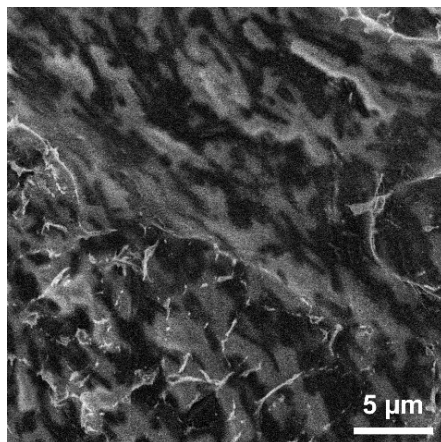
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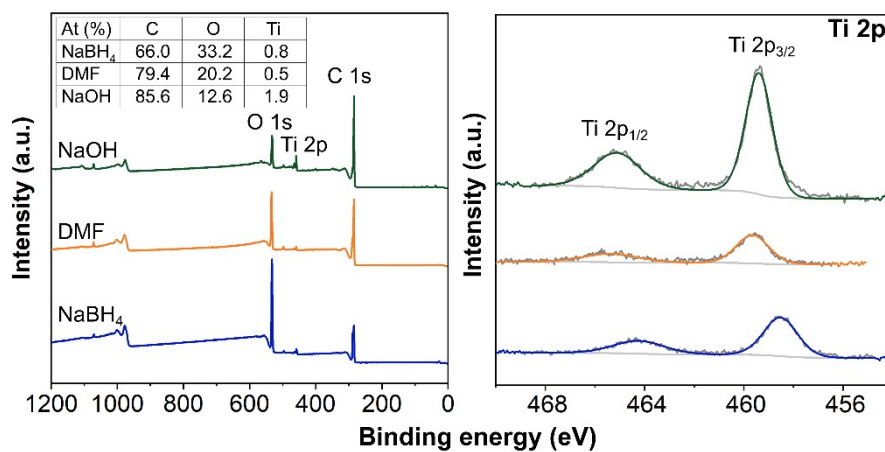
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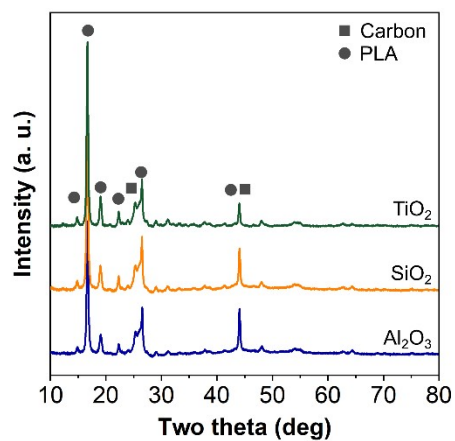
Keywords: additive manufacturing, fused deposition modeling, water splitting, scaling up, TiO<sub>2</sub>, SiO<sub>2</sub>, Al<sub>2</sub>O<sub>3</sub>



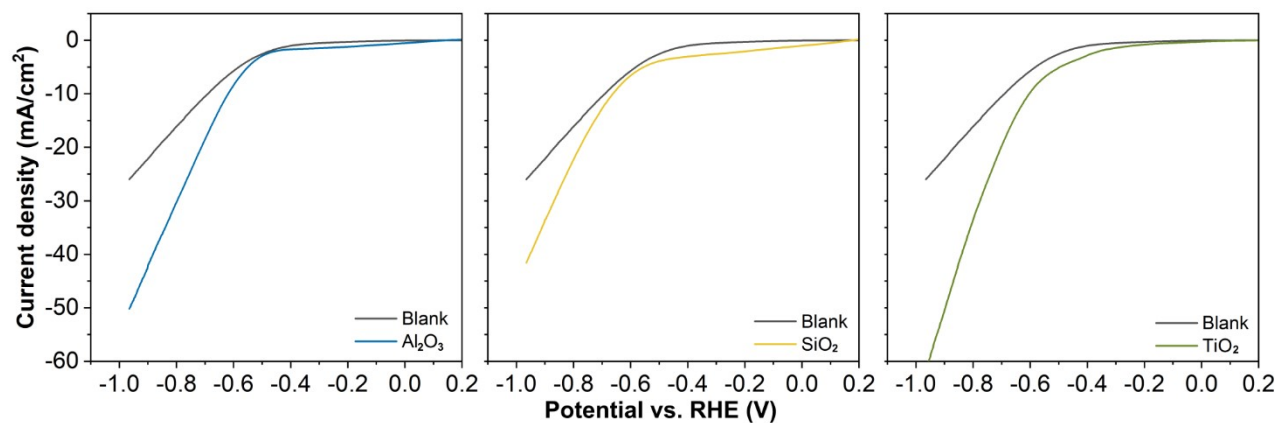
**Figure S1.** SEM image of an as-printed 3D carbon electrode.



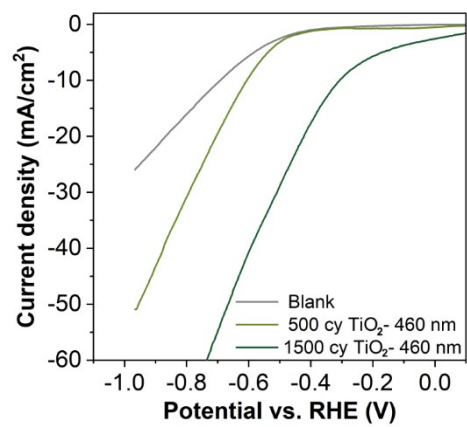
**Figure S2.** XPS survey and high-resolution Ti 2p spectra of 500 ALD cycles TiO<sub>2</sub> coated 3D carbon electrodes activated by different solvents, *i.e.*, NaBH<sub>4</sub>, DMF, and NaOH. The table in the inset shows the atomic concentration (at %) of C, O, and Ti obtained from the survey spectra.



**Figure S3.** XRD patterns of ALD coated 3D carbon electrodes, i.e., 50 cycles  $\text{Al}_2\text{O}_3$ , 50 cycles  $\text{SiO}_2$ , and 1500 cycles  $\text{TiO}_2$ .



**Figure S4.** LSV curves for HER in 0.5 M  $\text{H}_2\text{SO}_4$  electrolyte showing the effect of ALD coated electrodes, i.e., 50 cycles  $\text{Al}_2\text{O}_3$ , 50 cycles  $\text{SiO}_2$ , and 1500 cycles  $\text{TiO}_2$ .



**Figure S5.** LSV curves for HER in 0.5 M H<sub>2</sub>SO<sub>4</sub> electrolyte for blank, 500 and 1500 ALD cycles TiO<sub>2</sub> coated 3D carbon electrodes.