

## Electronic Supplementary Information

### The Reference Electrode Dilemma in Energy Conversion Electrocatalysis: “Right vs Okay vs Wrong”

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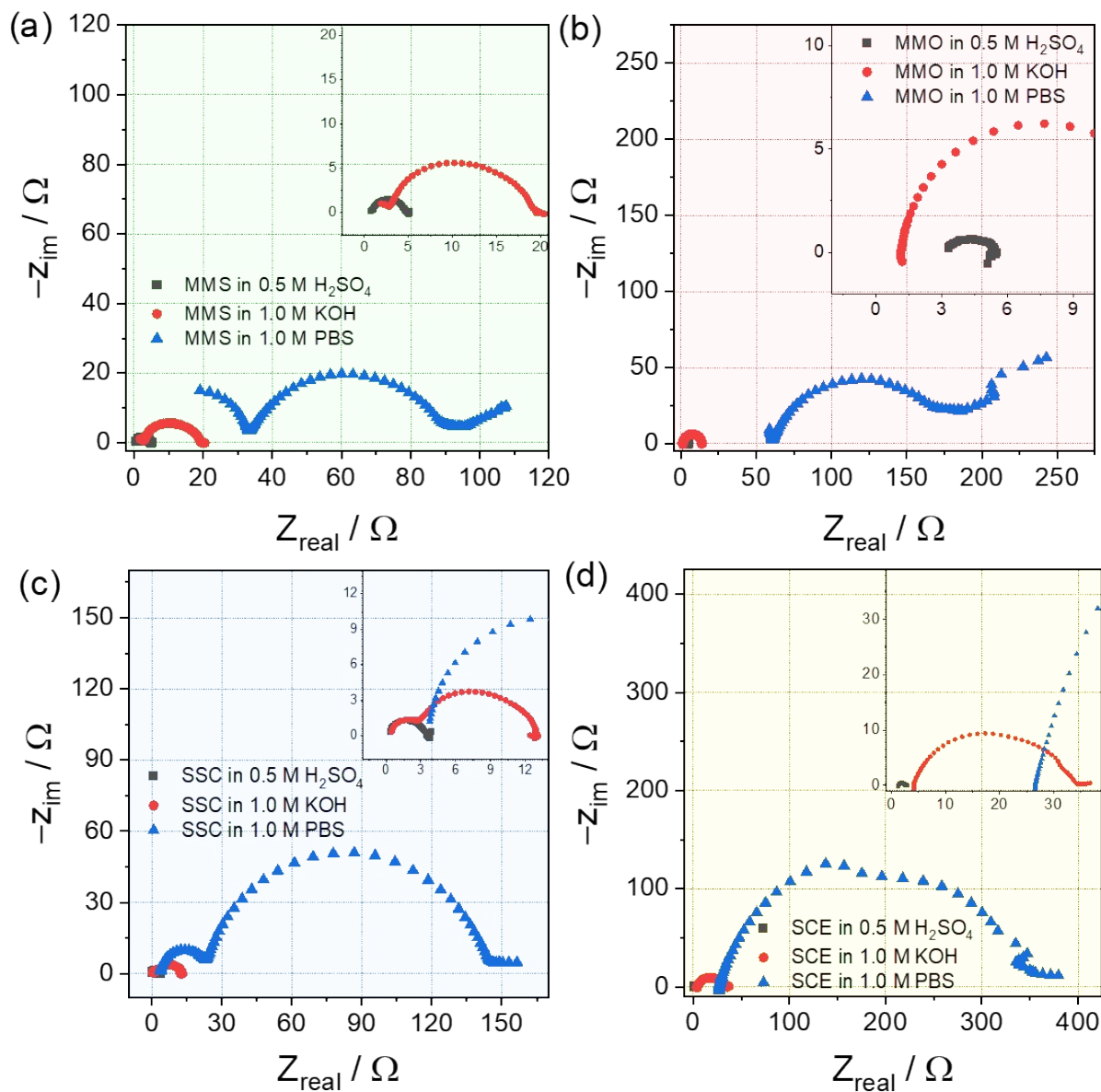
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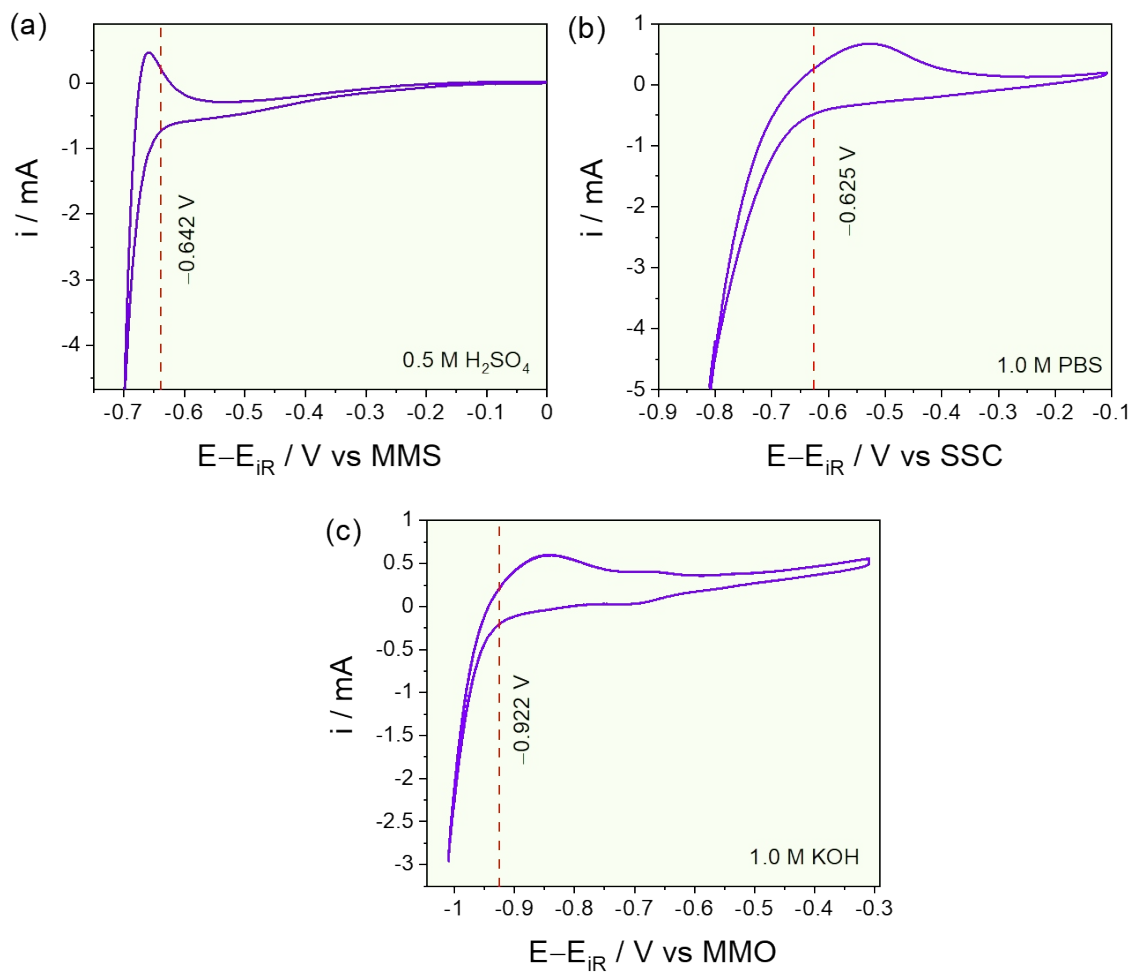
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#These authors have contributed equally!

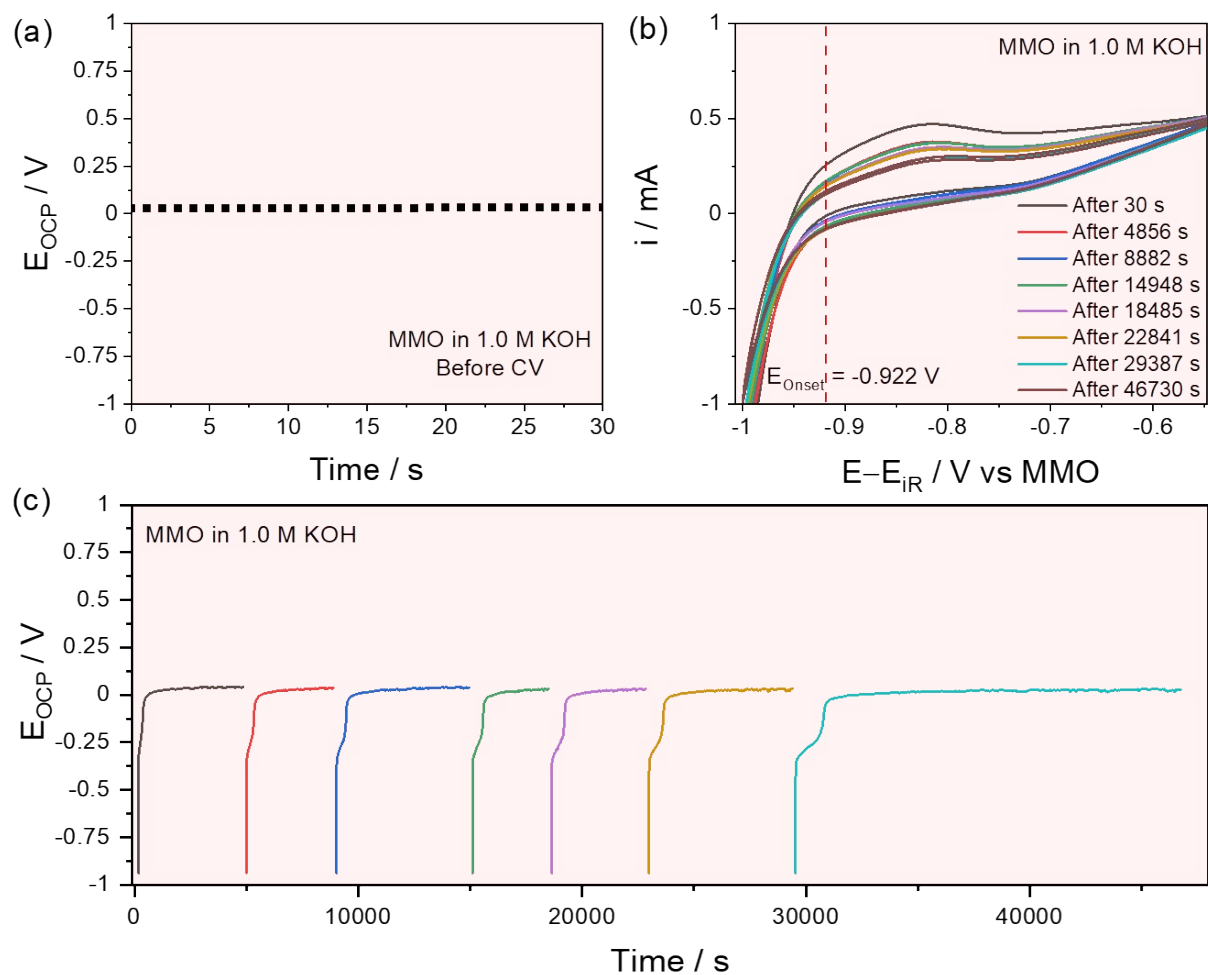
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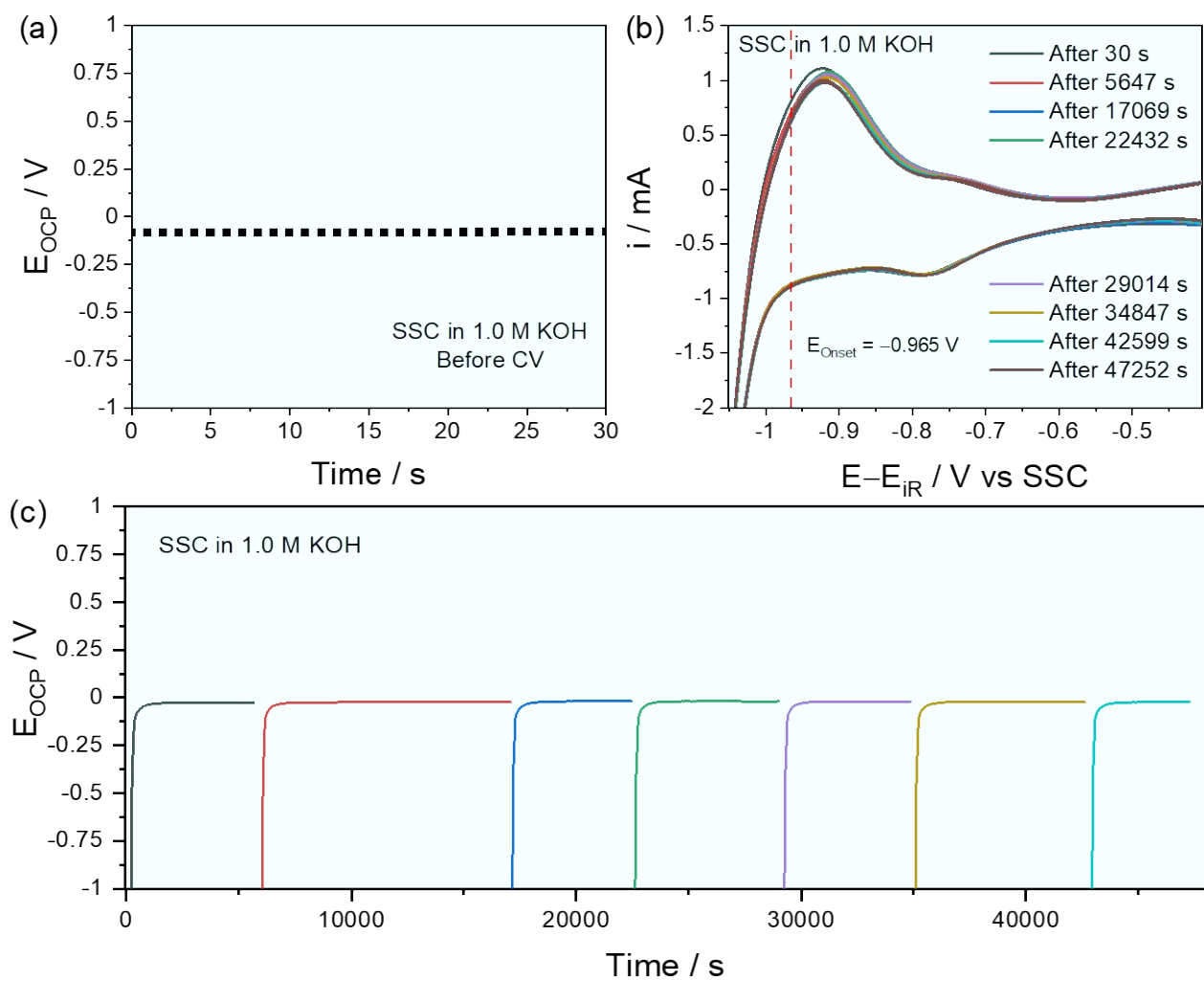
**Figure S1:** Nyquist plots of MMS (a), MMO (b), SSC (c), and SCE (d) reference electrodes acquired in 0.5 M  $H_2SO_4$  (black squares), 1.0 M KOH (red spheres), and 1.0 M PBS (blue pyramids).



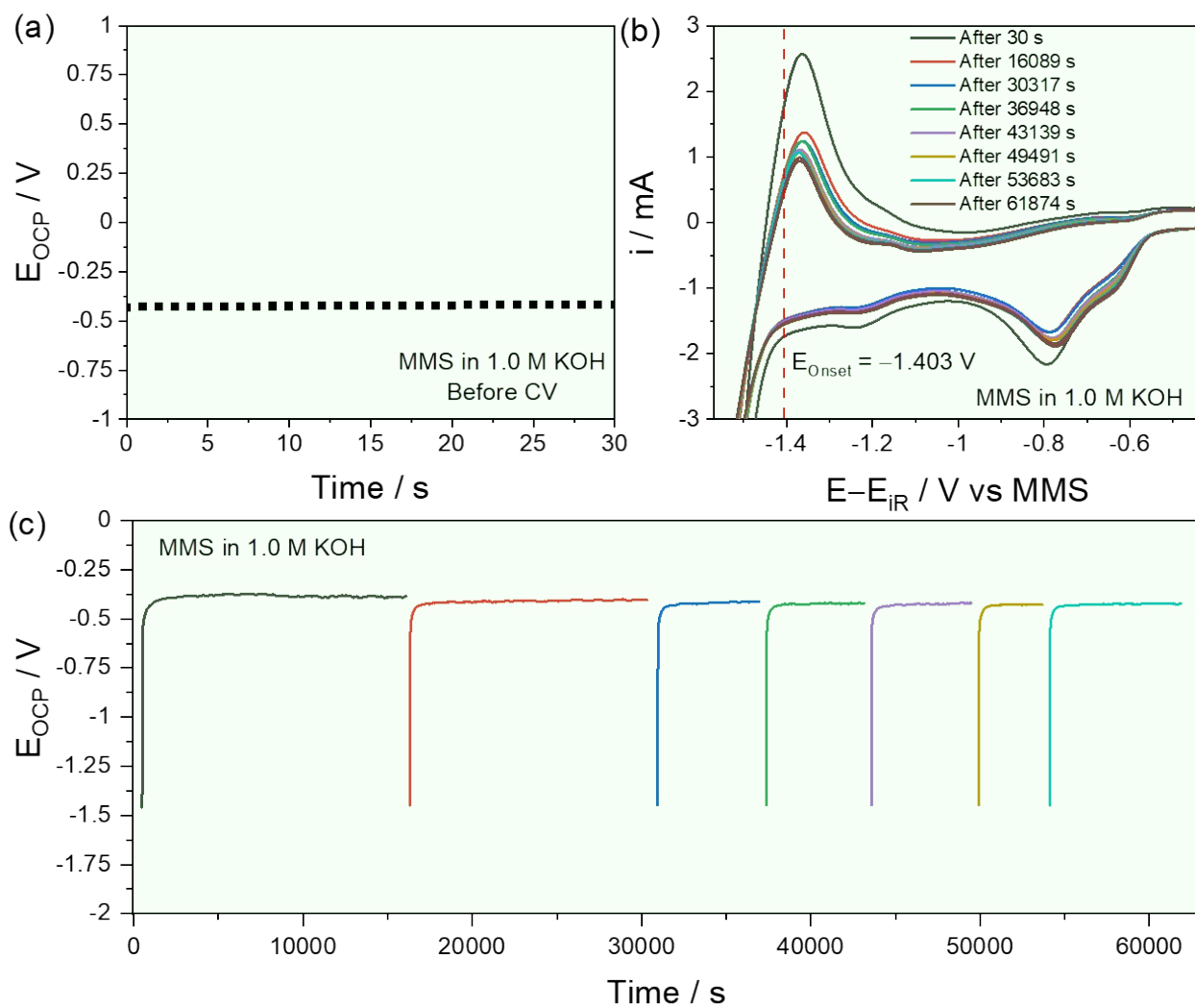
**Figure S2:** (a-c) HER CVs of Pt foil in 0.5 M H<sub>2</sub>SO<sub>4</sub>, 1.0 M PBS, and 1.0 M KOH screened against MMS, SSC, and MMO reference electrodes used for the calibration of the reference electrodes.



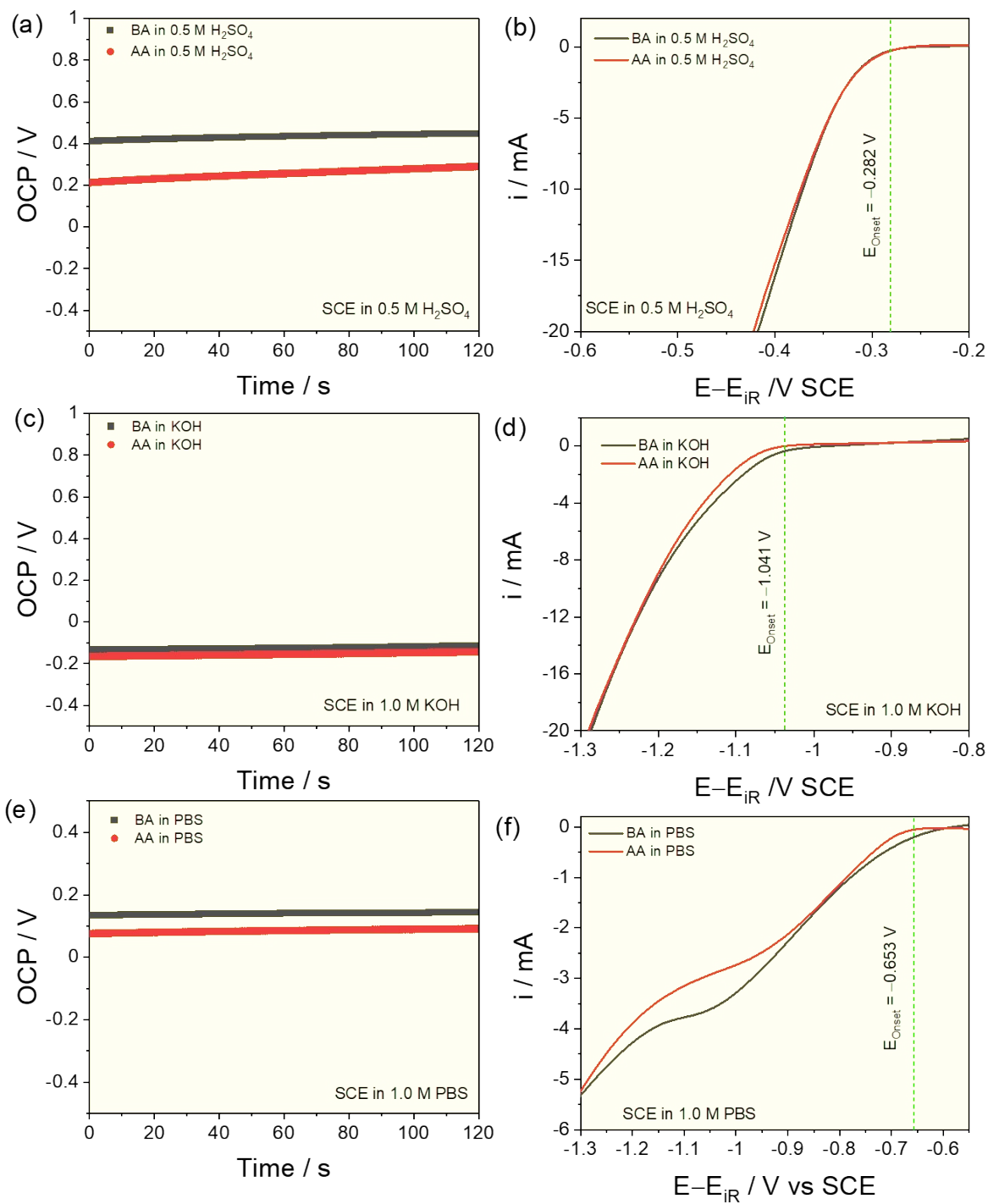
**Figure S3:** (a) Initial resting of electrodes for 30 s. (b) CVs recorded at random time intervals of monitoring OCP (c) for Pt foil against MMO in 1.0 M KOH.



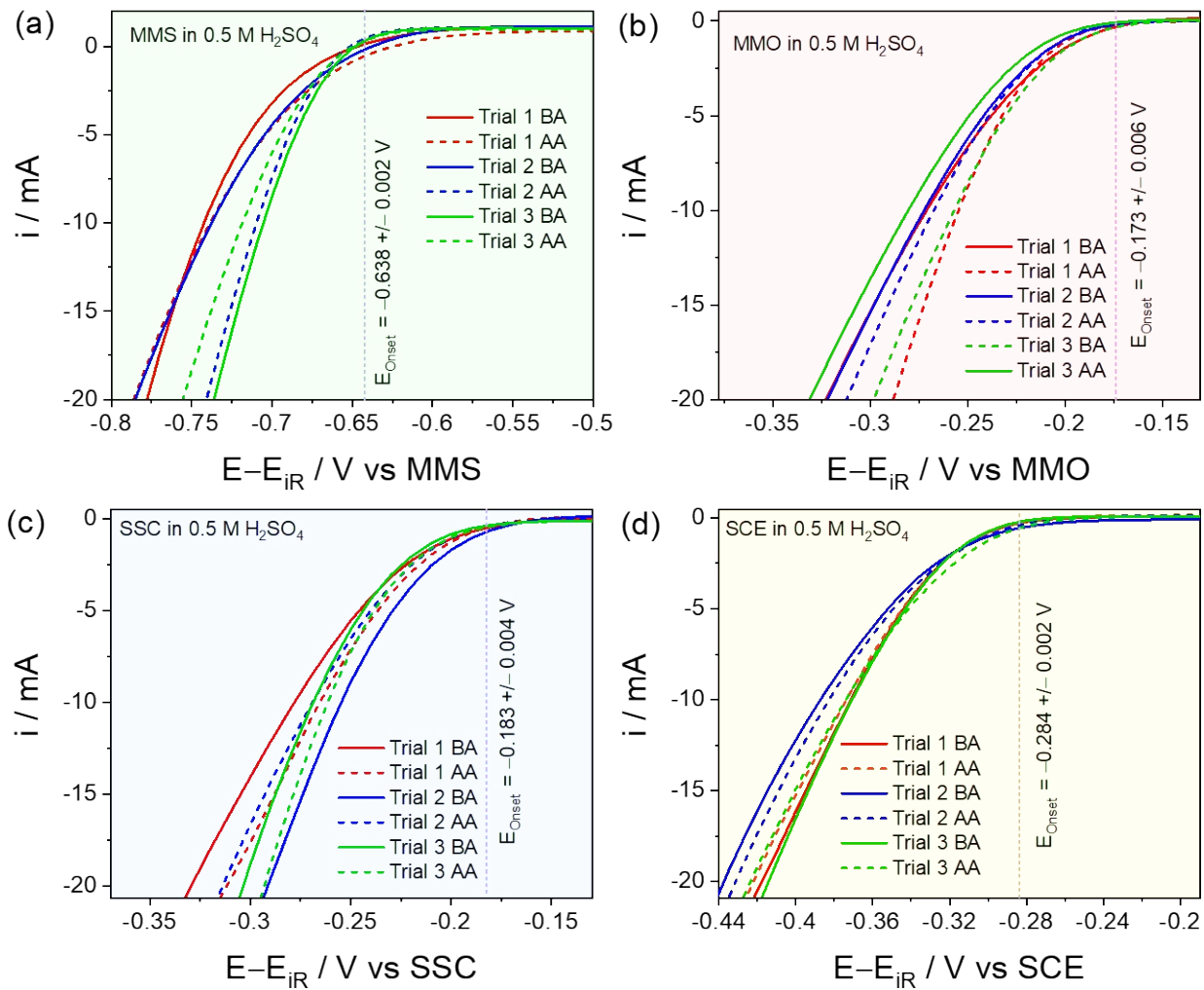
**Figure S4:** (a) Initial resting of electrodes for 30 s. (b) CVs recorded at random time intervals of monitoring OCP (c) for Pt foil against SSC in 1.0 M KOH.



**Figure S5:** (a) Initial resting of electrodes for 30 s. (b) CVs recorded at random time intervals of monitoring OCP (c) for Pt foil against MMS in 1.0 M KOH.

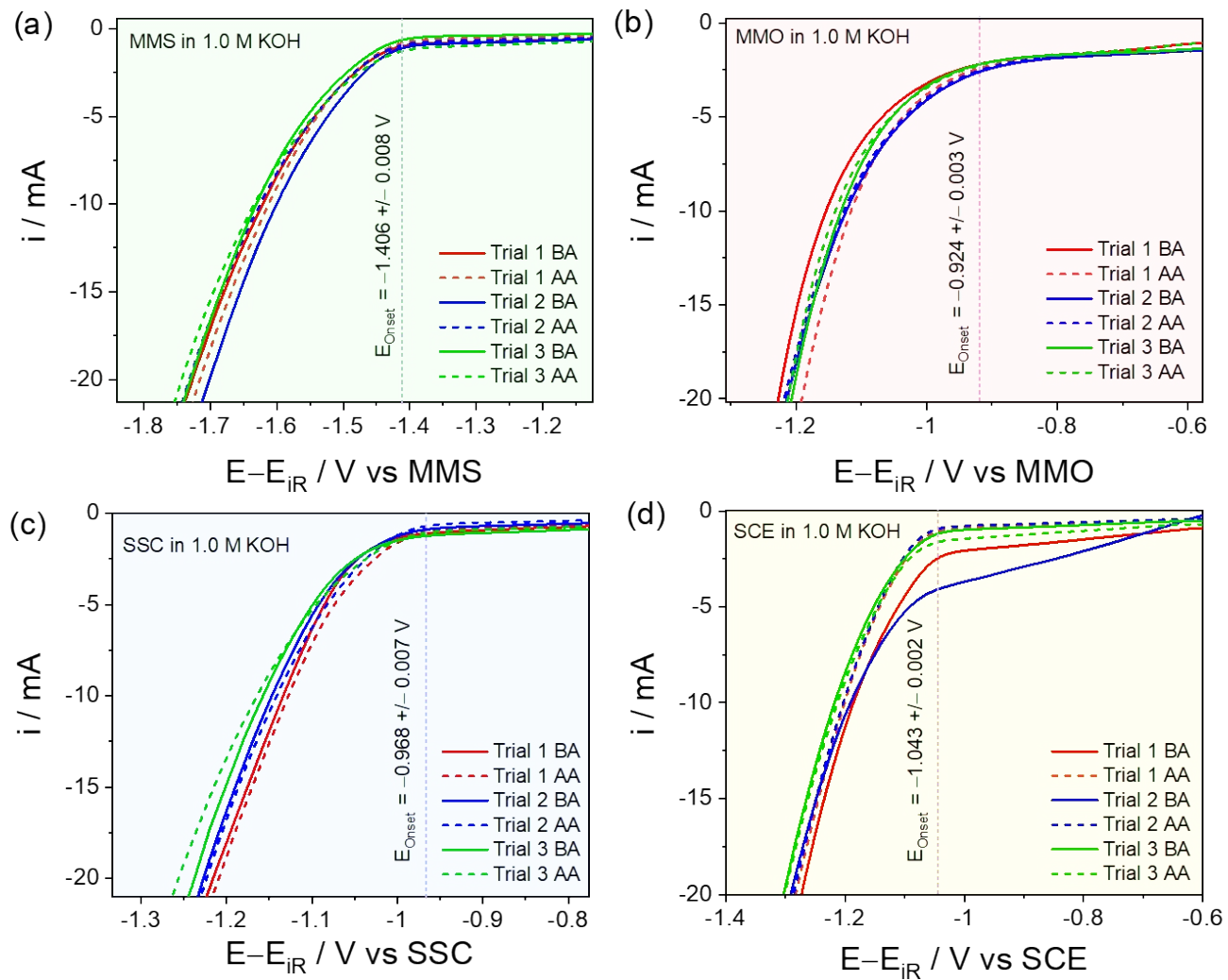


**Figure S6:** (a, c, e) OCP measurements made before and after 12 h aging for SCE, respectively in 0.5 M H<sub>2</sub>SO<sub>4</sub>, 1.0 M KOH, and 1.0 M PBS. (b, d, f) HER LSVs of Pt acquired against SCE under the same conditions, respectively.

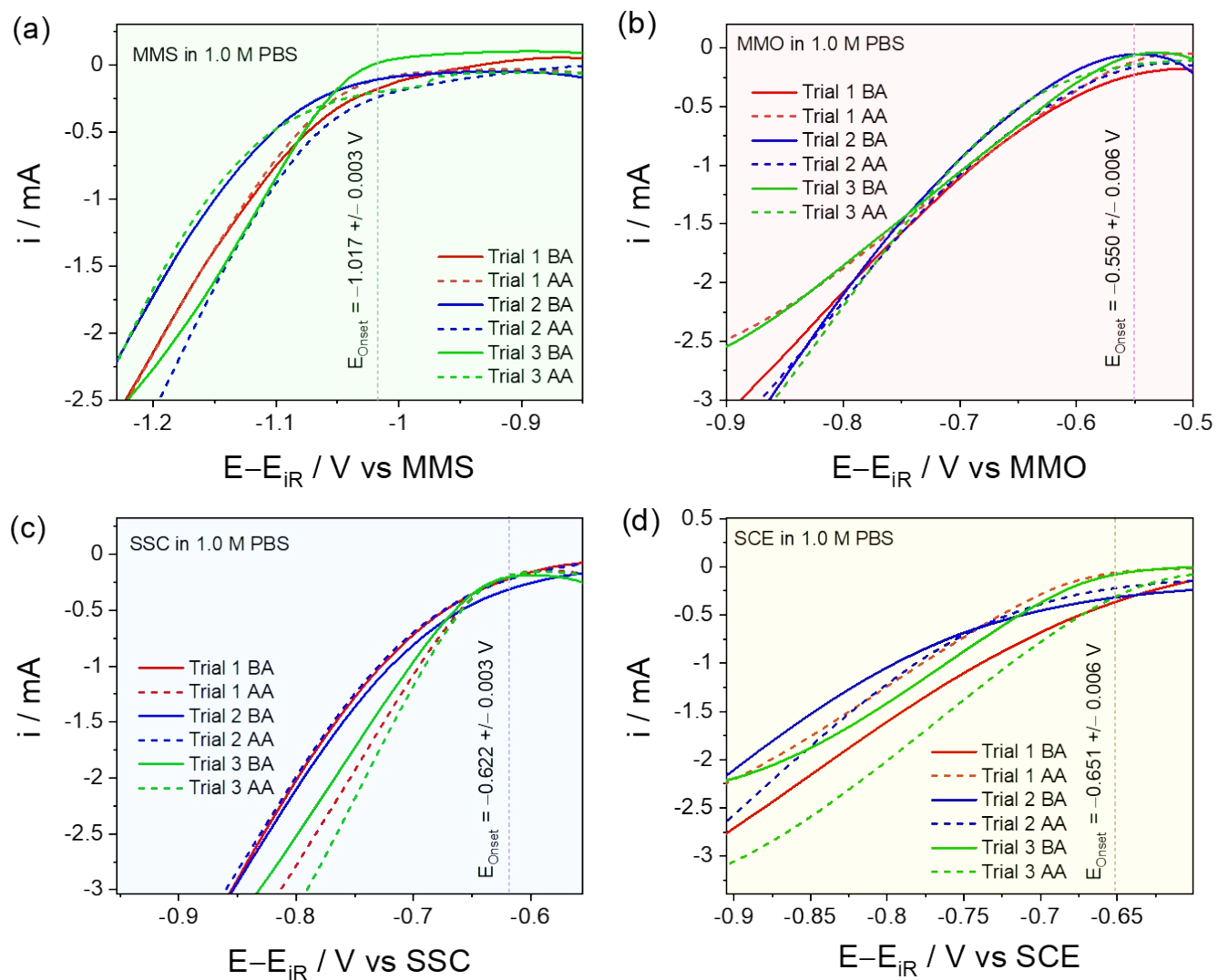


**Figure S7:** HER LSVs of Pt against MMS (a), MMO (b), SSC (c), and SCE (d) in 0.5 M H<sub>2</sub>SO<sub>4</sub>.





**Figure S8:** HER LSVs of Pt against MMS (a), MMO (b), SSC (c), and SCE (d) in 1.0 M KOH.



**Figure S9:** HER LSVs of Pt against MMS (a), MMO (b), SSC (c), and SCE (d) in 1.0 M PBS.