

Description of Additional supplementary file

Supplementary Movie 1:

Live video of the MEA system in operation, with NO₃RR and OER, performed in the left and right chambers respectively. Video playback speed is 30 times faster.

Supplementary Data 1:

1.Co(100).vasp represents the surface model of pure cobalt with (100) crystallographic orientation. 2.Co₆Ni₄.vasp constitutes the surface model employed in this study, which has undergone rigorous site-specific testing and thickness optimization procedures. 3.Ni(111).vasp corresponds to the surface model of pure nickel with (111) crystallographic orientation. 4.Co₆Ni₄.xyz serves as the trajectory file for interfacial dynamic reactions, from which the atomic configuration of each simulation frame can be extracted