

Supplementary Information

Engineering Zeolitic Imidazolate Framework Derivatives via Cation-Etching Strategy for Efficient Seawater Oxidation

Zhihan Chen ^{1,†}, Ying Wang ^{1,†}, Lin Xu ^{1,*}, Meilan Huang ², Lei Wang ³, Siqi Yang ⁴, Qinqing Dong ^{1,*} and Yan Zheng ^{1,*}

¹ Zhejiang Key Laboratory of Pollution Control for Port-Petrochemical Industry, School of Petrochemical Engineering & Environment, Zhejiang Ocean University, Zhoushan 316022, China

² School of Chemistry and Chemical Engineering, Queen's University of Belfast, Belfast BT9 5AG, UK

³ CNOOC China Limited, Shanghai Branch, Shanghai 200330, China

⁴ State Key Laboratory of Oil and Gas Equipment, CNPC Tubular Goods Research Institute, Xi'an 710076, China

* Correspondence: xulin_14@zjou.edu.cn (L.X.); dongqinqing@163.com (Q.D.); zhengyan5856@126.com (Y.Z.)

† These authors contributed equally to this work.

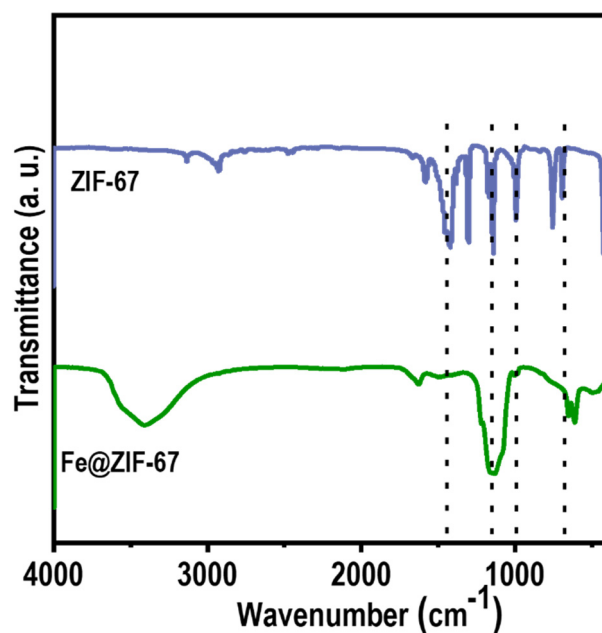


Figure S1. FT-IR spectrum of ZIF-67 and Fe@ZIF-67.

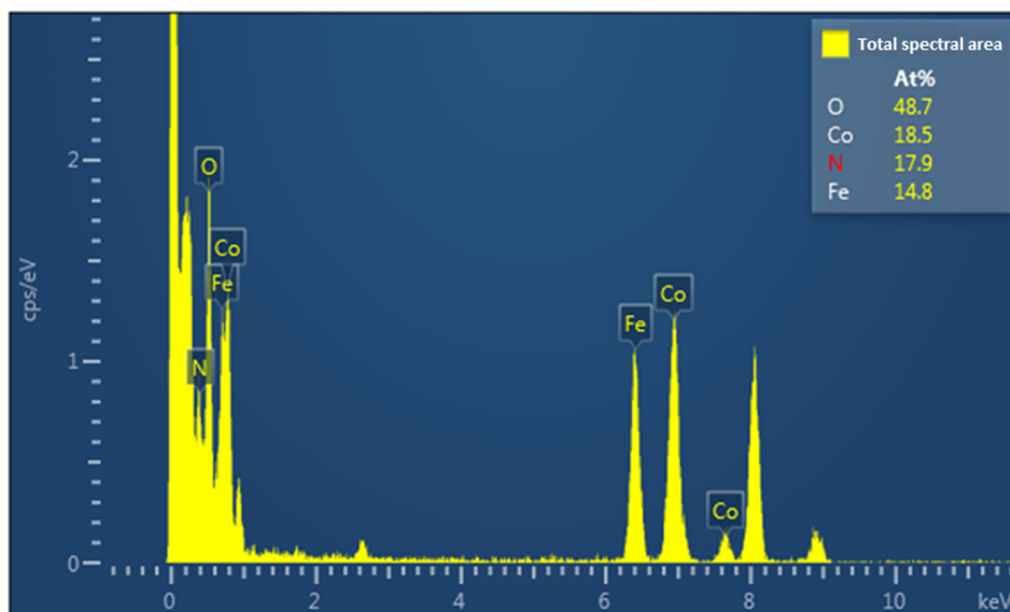


Figure S2. TEM-EDS of Fe@ZIF-67.

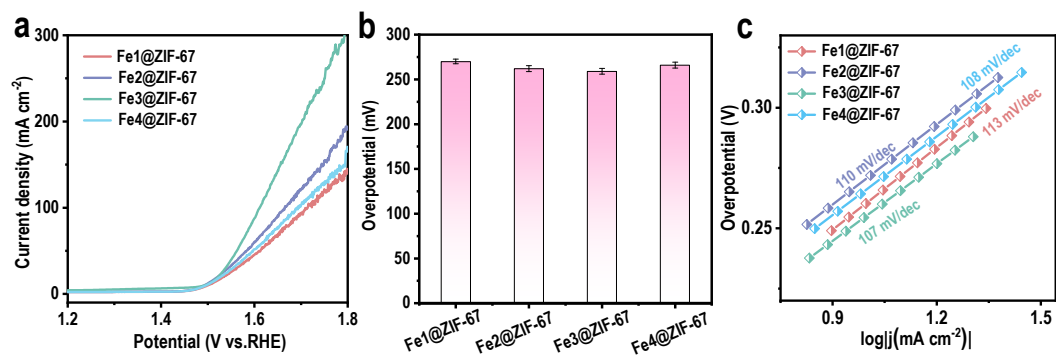


Figure S3. (a) LSV curves for catalysing OER, (b) the overpotential at 10 mA cm⁻², and (c) Tafel plots for Fe1@ZIF-67, Fe2@ZIF-67, Fe3@ZIF-67, and Fe4@ZIF-67 in 1.0 M KOH + 0.5 M NaCl.

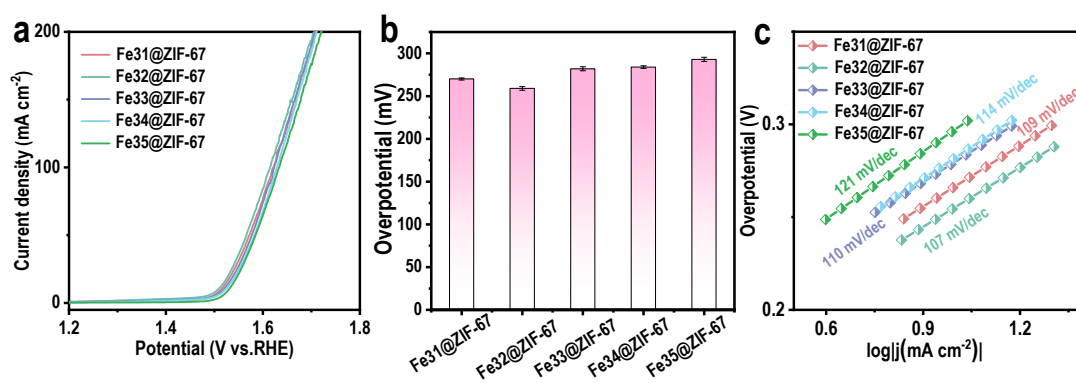


Figure S4. (a) LSV curves for catalysing OER, (b) the overpotential at 10 mA cm^{-2} , and (c) Tafel plots for Fe31@ZIF-67, Fe32@ZIF-67, Fe33@ZIF-67, and Fe34@ZIF-67 in $1.0 \text{ M KOH} + 0.5 \text{ M NaCl}$.

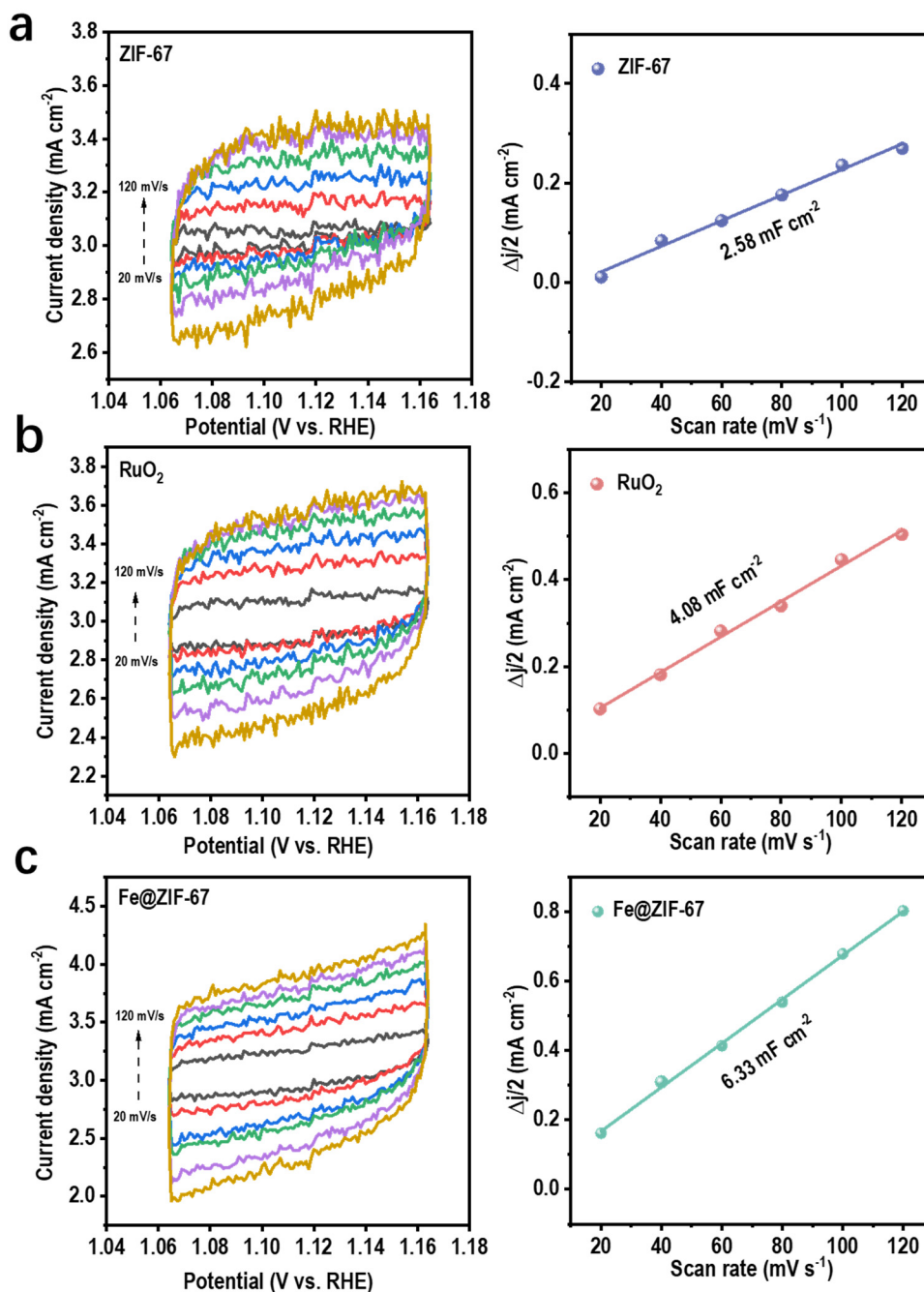


Figure S5. CV plots at different scan rates (20 to 120 mV s⁻¹) and charge current density difference versus different scan rates for (a) ZIF-67, (b) RuO₂, and (c) Fe@ZIF-67.

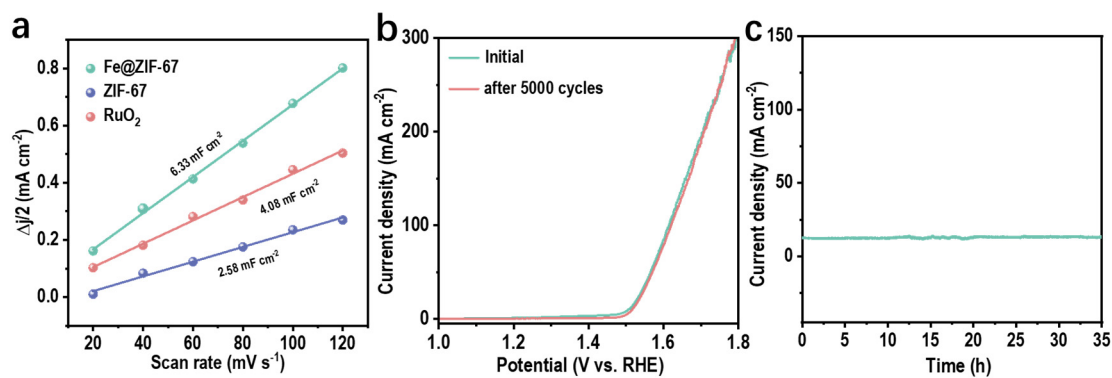


Figure S6. (a) C_{dl} assessed at different current densities versus scan rate of ZIF-67, RuO₂, and Fe@ZIF-67; (b) OER polarisation curves of Fe@ZIF-67 initial and after 2000 CV cycles; (c) The durability test of OER for Fe@ZIF-67.

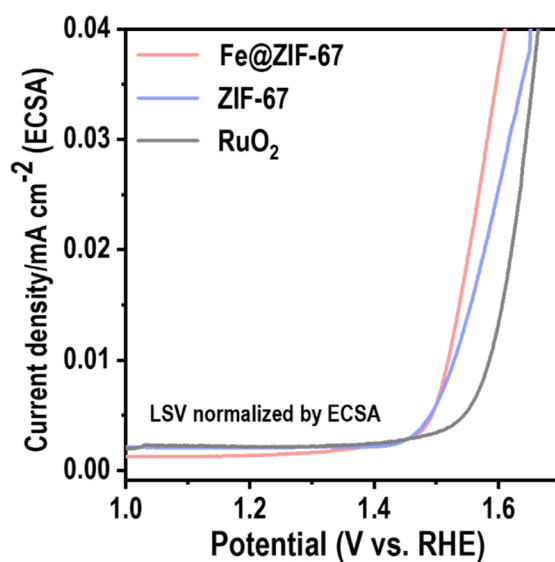


Figure S7. LSV normalized by ECSA for Fe@ZIF-67, RuO₂, and ZIF-67.

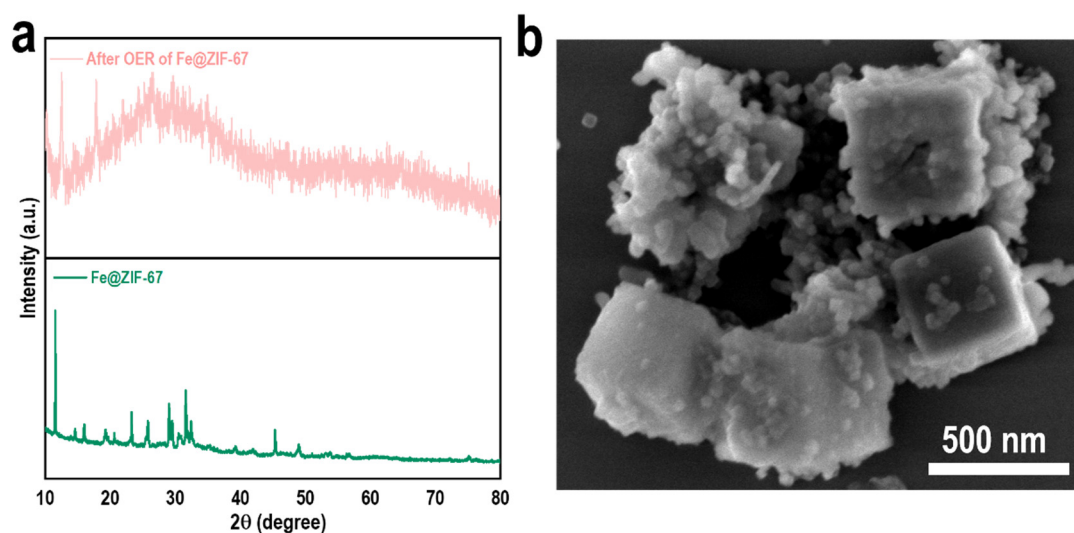


Figure S8. (a) XRD pattern and b) SEM image of Fe@ZIF-67 after stability test for OER.

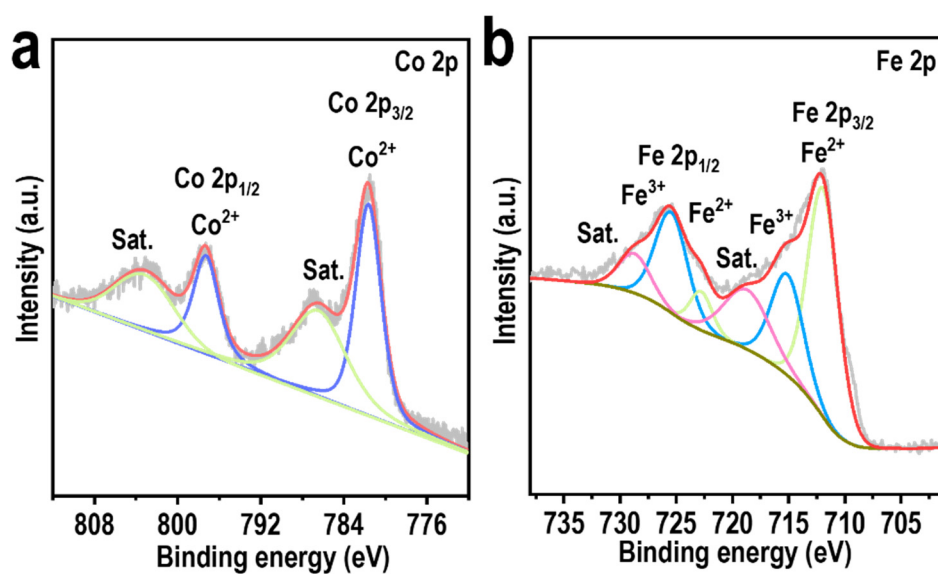


Figure S9. The high-resolution XPS spectra of Fe@ZIF-67 in (a) Co 2p and (b) Fe 2p regions after the stability test for OER.

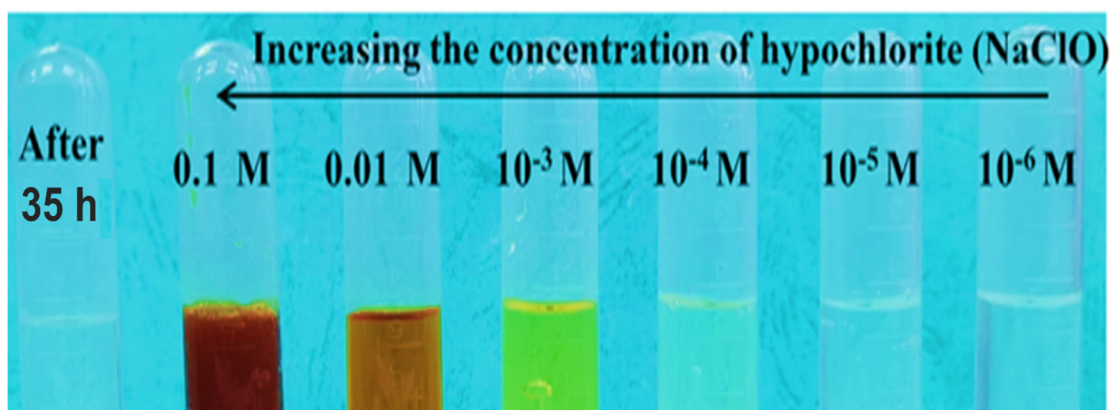


Figure S10. The potassium iodide-starch test on the electrolyte after the stability test of Fe@ZIF-67.

Table S1. The main ion composition of the natural seawater was obtained from Zhoushan, Zhejiang Province.

Ion species	percentages(%)
Cl ⁻	55.08
Na ⁺	30.65
SO ₄ ²⁻	7.65
Mg ²⁺	3.65
Ca ²⁺	1.18
K ⁺	1.12
Others	0.67

Table S2. Co and Fe content determined by ICP-MS for ZIF-67 and Fe@ZIF-67.

Samples	Co (%)	Fe (%)
ZIF-67	37.4	—
Fe@ZIF-67	26.1	18.5