# Supporting Information

# A synergistic anti-corrosion system based on durable superhydrophobic F-$SiO_2$/epoxy coatings and self-powered cathodic protection

*Xiukun Liu[a, †], Xu Xu[a, †], Fangjia Zhang[b], Xiangchao Ge[b], Haifeng Ji[b], Yuqi Li[a,*], Shaorong Lu[a], and Zhen Wen[b,*]*

[a] Key Laboratory of New Processing Technology for Nonferrous Metals and Materials, Ministry of Education, School of Material Science and Engineering, Guilin University of Technology, Guilin, 541004, China.

[b] Institute of Functional Nano & Soft Materials (FUNSOM), Jiangsu Key Laboratory for Carbon-Based Functional Materials and Devices, Soochow University, Suzhou 215123, China.

[†] These authors contributed equally to this work.

∗ Corresponding Authors: liyuqi@glut.edu.cn (Y. Li); wenzhen2011@suda.edu.cn (Z. Wen).

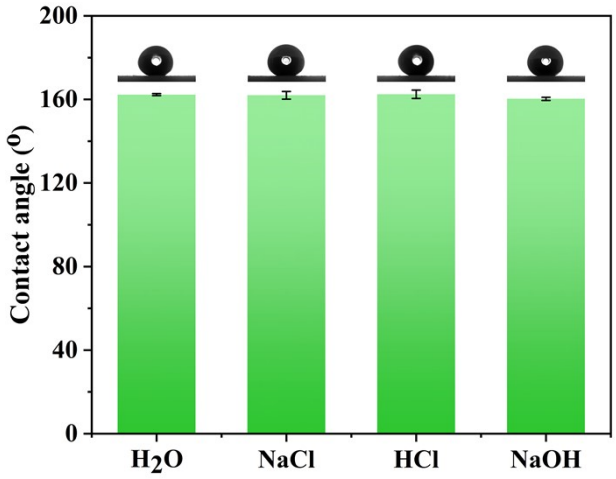


**Fig. S1** Contact angle of FE-8 coating under different solutions

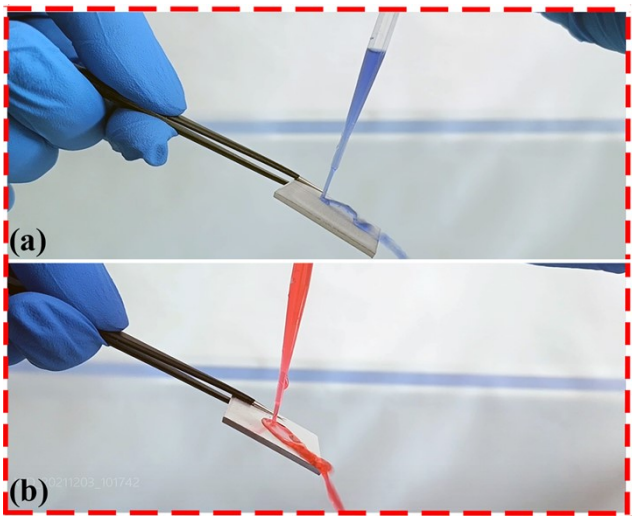


**Fig. S2** Water flow testing: (a) for aluminum with FE-8 coating; (b) for uncoated aluminum.

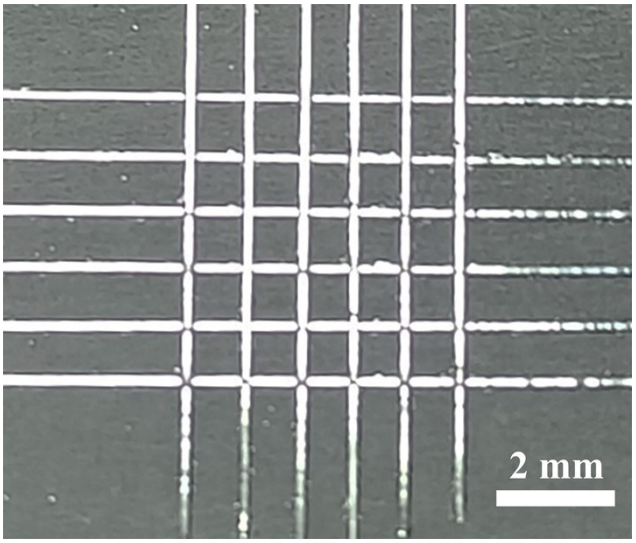


**Fig. S3** Optical photos of FE-8 after the cross-cut tape test

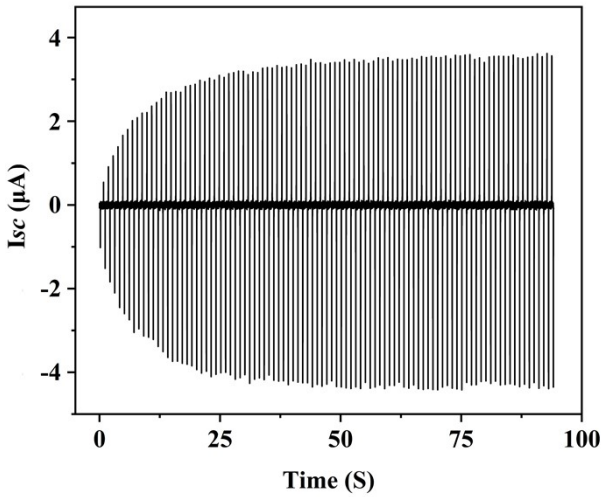


**Fig. S4** Charge accumulation process of FE-TENG.

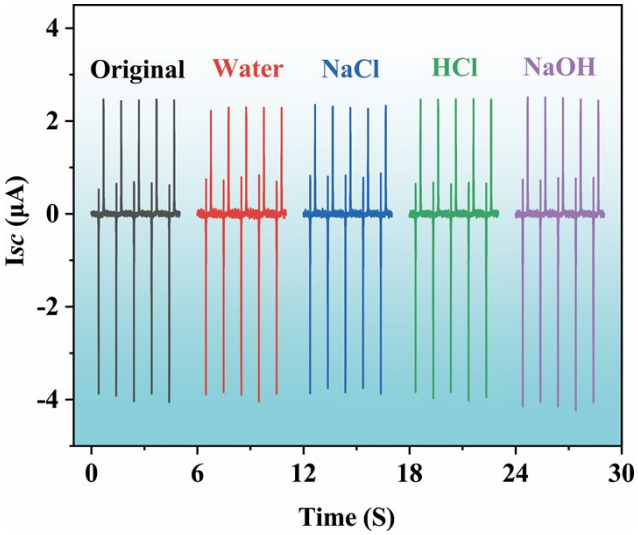


**Fig. S5** $I_{sc}$ of FE-TENG after contamination by different solutions.

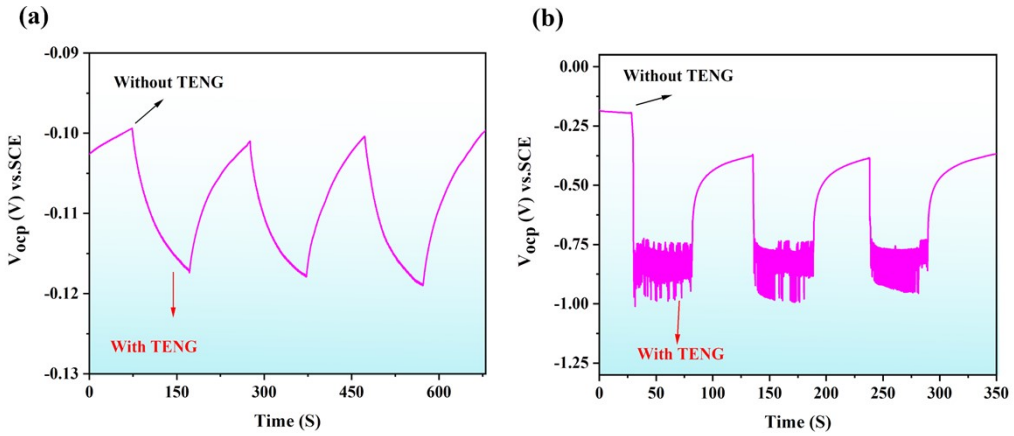


**Fig. S6** OCP variation with and without FE-TENG protection of the (a) 304SS and (b) FE-8 coated 304SS.

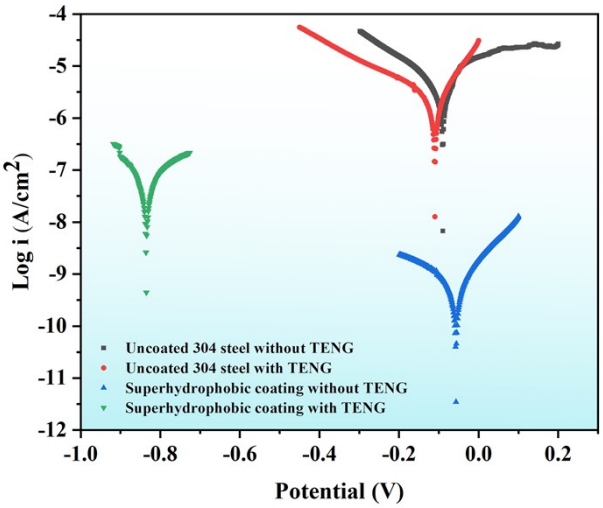


**Fig. S7** Tafel potential polarization curves of Bare 304 SS without TENG protection, Bare 304 SS with TENG protection, FE-8 coated 304 SS without TENG protection and FE-8 coated 304 SS with TENG protection.

**Table S1.** Electrochemical parameters obtained from the Tafel polarization curve of the aluminum sheet.

| **Samples** | **$E_{corr}$/v** | **$I_{corr}$/ A·cm$^{-2}$** | **$-\beta_c$/mV·dec$^{-1}$** | **$\beta_a$/mV·dec$^{-1}$** |
|---|---|---|---|---|
| Bare aluminum sheet without FE-TENG | −0.80 | $2.76\times10^{-7}$ | 411 | 29 |
| Bare aluminum sheet with FE-TENG | −0.88 | $4.47\times10^{-8}$ | 41 | 49 |
| FE-8 coated aluminum sheet without FE-TENG | −0.63 | $2.37\times10^{-10}$ | 186 | 136 |
| FE-8 coated aluminum sheet with FE-TENG | −1.34 | $2.51\times10^{-9}$ | 64 | 79 |

**Table S2.** Results of fitting EIS data for uncoated aluminum without FE-TENG, uncoated aluminum with FE-TENG, and superhydrophobic coating without FE-TENG in 3.5 wt% NaCl solution by immersion.

| **Samples** | $\mathbf{R_s}$ **($\Omega \cdot cm^{-2}$)** | $\mathbf{R_{ct}}$ **($\Omega \cdot cm^{-2}$)** | $\mathbf{Q_{dl}}$ **($\Omega \cdot s^n \cdot cm^{-2}$)** | **n** | $\mathbf{C_{dl}}$ **($\mu F \cdot cm^{-2}$)** | $\mathbf{R_{coat}}$ **($\Omega \cdot cm^{-2}$)** | $\mathbf{Q_{coa2t}}$ **($\Omega \cdot s^n \cdot cm^{-2}$)** |
|---|---|---|---|---|---|---|---|
| Bare aluminum sheet without FE-TENG | 17.62 | $7.11\times10^{4}$ | $5.98\times10^{-6}$ | 0.89 | $1.92\times10^{-6}$ | —— | —— |
| Bare aluminum sheet with FE-TENG | 15.35 | $4.32\times10^{4}$ | $8.55\times10^{-6}$ | 0.85 | $1.76\times10^{-6}$ | —— | —— |
| FE-8 coated aluminum sheet without FE-TENG | 0.01 | $2.52\times10^{8}$ | $2.66\times10^{-9}$ | 0.83 | $1.81\times10^{-11}$ | 10807 | $2.66\times10^{-10}$ |

EIS: Electrochemical impedance spectroscopy

**Table S3**. Materials and properties of triboelectric nanogenerators in self-powered anti-corrosion systems.

| Triboelectric materials | $I_{sc}$ (μA) | $V_{oc}$ (V) | $Q_{sc}$ (nC) | OCP Change value (mV) | Energy source | Ref. |
|---|---|---|---|---|---|---|
| Al/Kapton | 0.2 | / | 13.5 | 70 | Water wave | [S1] |
| Water/MAO-F | 6 | / | 300 | 670 | Water wave/8 Hz | [S2] |
| Paper/PVDF | 30 | 1000 | / | 450 | Mechanical energy/2 Hz | [S3] |
| PVA/PTFE | 29.72 | 405.3 | / | 590 | Wind | [S4] |
| PPy NWs/PVDF | 33.7 | 351 | / | 260 | Mechanical energy/8 Hz | [S5] |
| FE Coatings/ | 4.12 | 114.4 | 32.74 | 796 | Mechanical energy/1 Hz | This work |
| Silicone Rubber | 0.4 | 19 | 7.5 | 287 | Water wave | |

**Reference:**


S1. W. Guo, X. Li, M. Chen, L. Xu, L. Dong, X. Cao, W. Tang, J. Zhu, C. Lin, C. Pan, Z.L. Wang, *Adv. Funct. Mater.* 24 (2014) 6691-6699.

S2. C. Xu, Y. Liu, Y. Liu, Y. Zheng, Y. Feng, B. Wang, X. Kong, X. Zhang, D. Wang, *Appl. Mater. Today* 20 (2020) 100645.

S3. Y. Feng, Y. Zheng, Z.U. Rahman, D. Wang, F. Zhou, W. Liu, *J. Mater. Chem. A* 4(46) (2016) 18022-18030.

S4. W. Sun, N. Wang, J. Li, S. Xu, L. Song, Y. Liu, D. Wang, *Electrochim. Acta* 391 (2021) 138994-139004.

S5. J. Baux, N. Caussé, J. Esvan, S. Delaunay, J. Tireau, M. Roy, D. You, N. Pébère, *Electrochim. Acta* 283 (2018) 699-707.