

Supporting Information for

In situ laser-assisted synthesis of MoS₂ anchored on 3D porous graphene foam for enhanced alkaline hydrogen generation

Ling Zhang^a, Wenxiang Fu^a, Jie Yang^a, Junchao Yang^a, Chuan Zhou^a, Jiang Zhao^{a,*},
Qibin Huang^{a,*}

State Key Laboratory of NBC Protection for Civilian, Beijing 102205, China

Corresponding author. *E-mail: 13021911723@163.com (J.Z.);
zhanglingscdx@163.com (Q.H.)

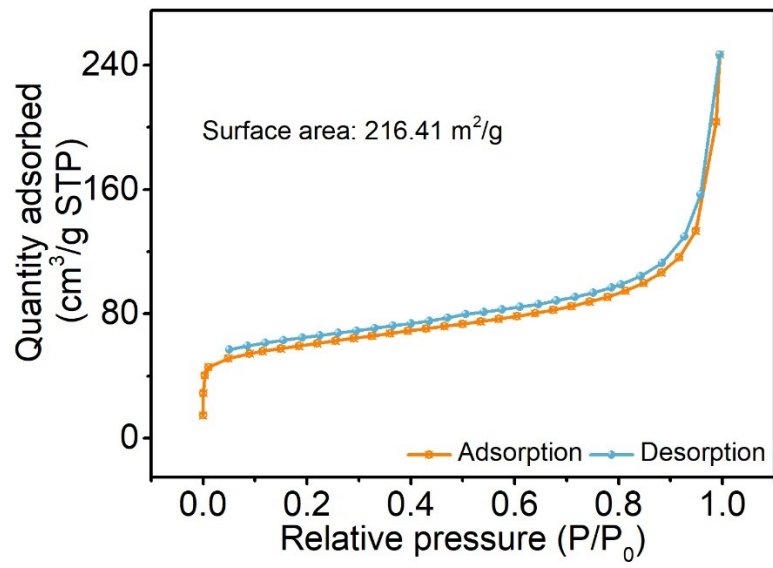


Fig. S1. N₂ adsorption-desorption isotherm of LIG/MoS₂.

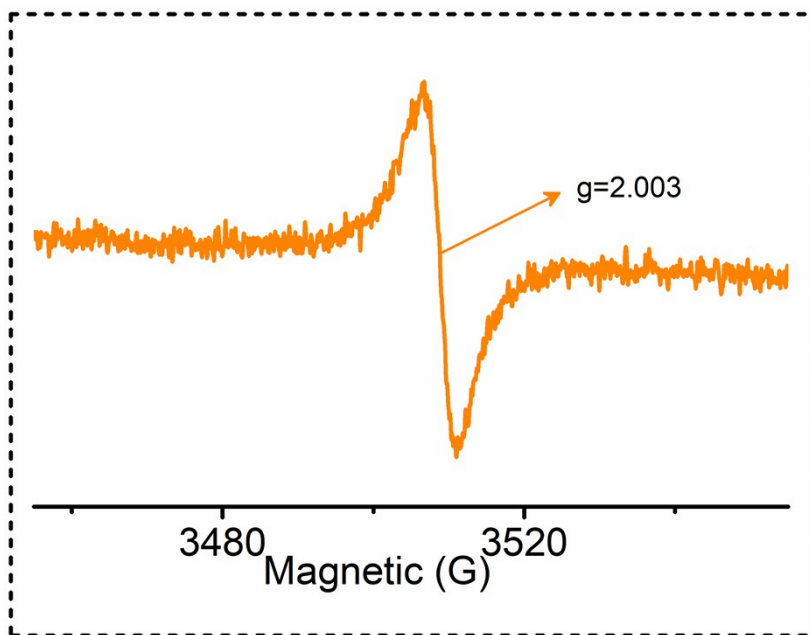


Fig. S2. EPR spectrum of LIG/MoS₂.

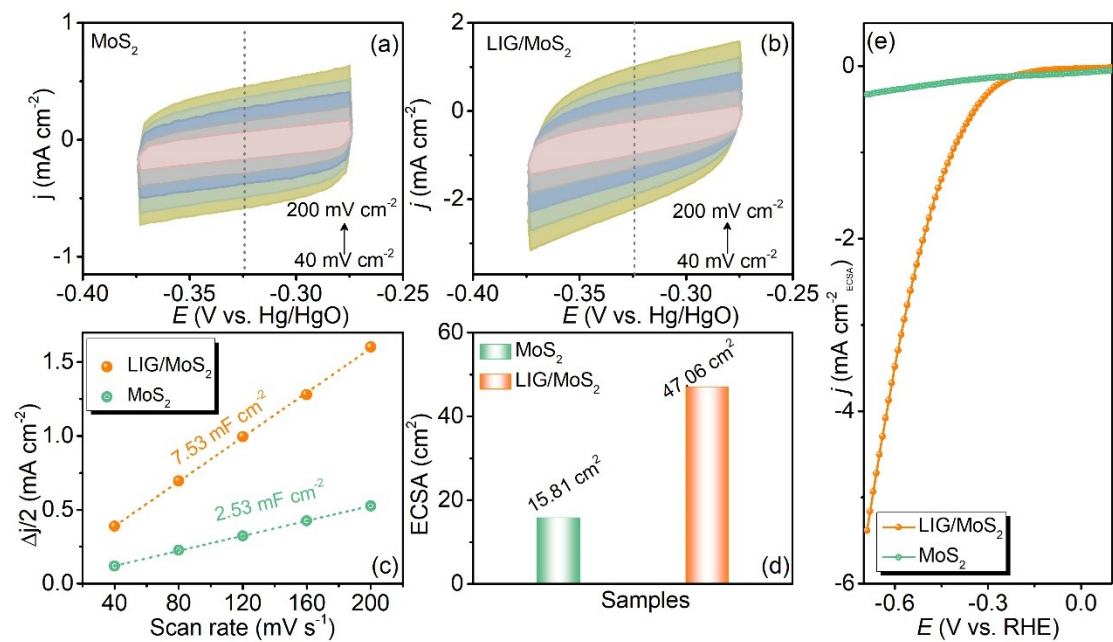


Fig. S3. CV curves in the potential window of -0.374~0.274 V vs. Hg/HgO for (a) commercial MoS₂ and (b) LIG/MoS₂ at various scan rates (40 to 200 mV cm⁻²). (c) Scan rate dependent Δj at -0.324 V vs. Hg/HgO for MoS₂ and LIG/MoS₂ and (d) corresponding ECSAs. (e) The ESCA-normalized polarization curves of MoS₂ and LIG/MoS₂.

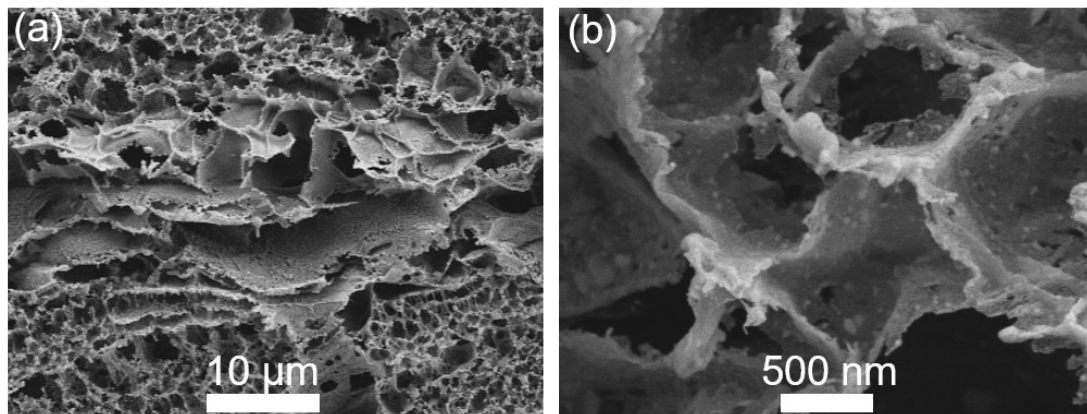


Fig. S4. SEM images of LIG/MoS₂ after long-term stability test.

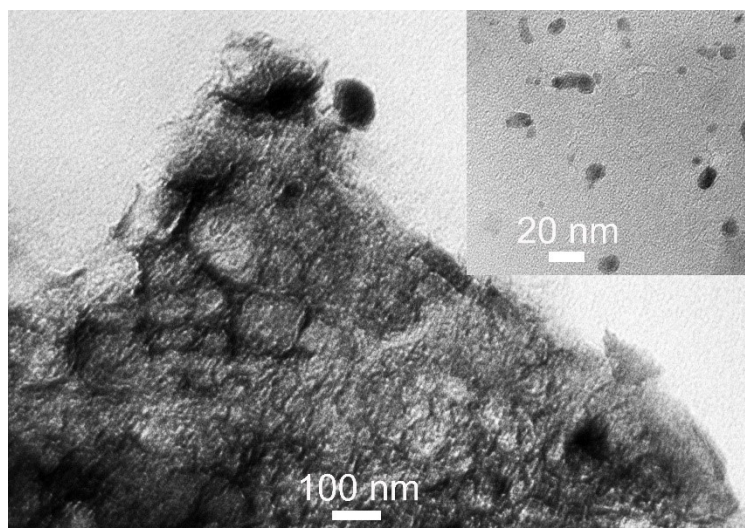


Fig. S5. TEM images of LIG/MoS₂ after long-term stability test.

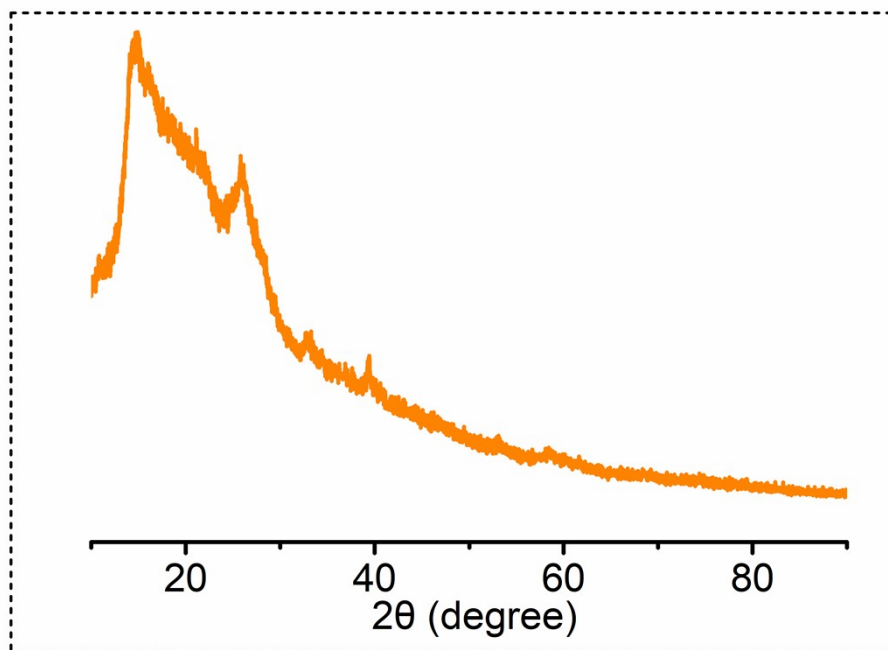


Fig. S6. XRD pattern of LIG/MoS₂ after long-term stability test.

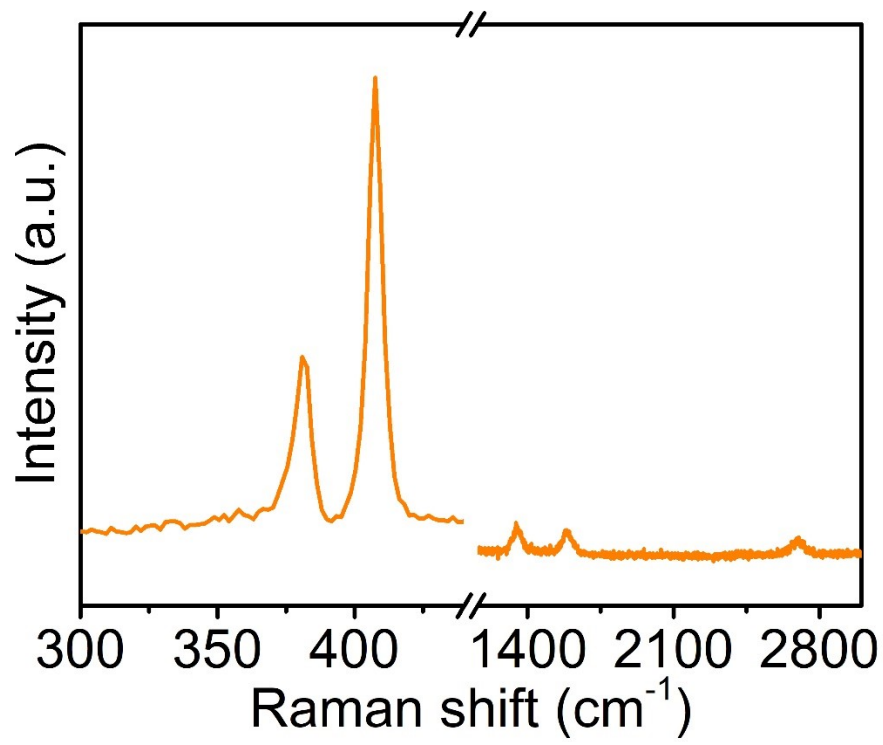


Fig. S7. Raman spectrum of LIG/MoS₂ after long-term stability test.

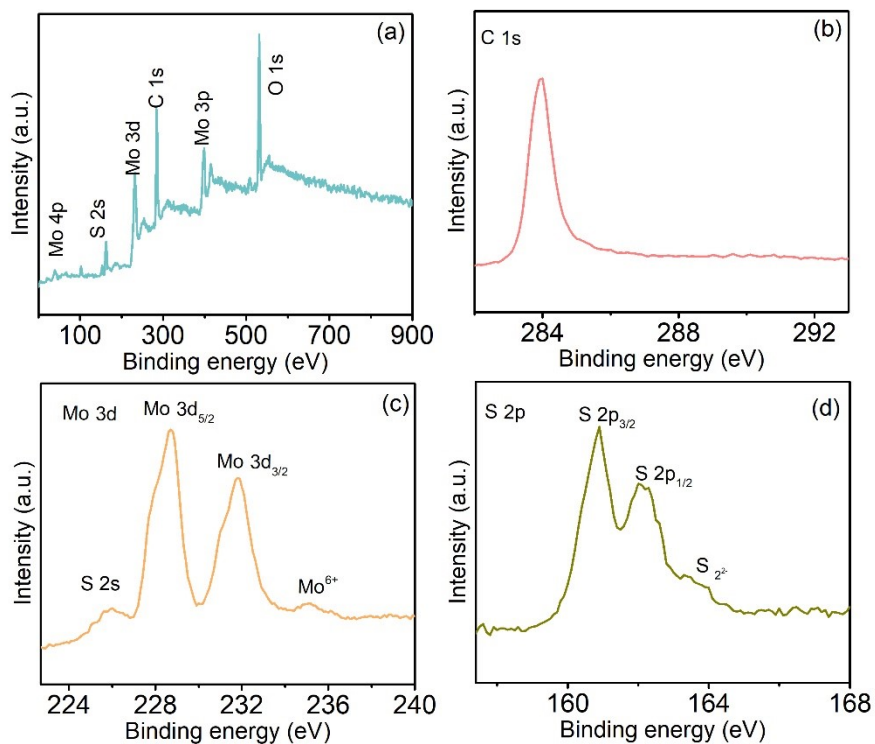


Fig. S8. (a) XPS survey spectrum for LIG/MoS₂ after long-term stability test and corresponding high-resolution XPS profiles of (b) C 1s, (c) Mo 3d and (d) S 2p.

Table S1. Comparison of the HER performances of LiG/MoS₂ with other reported MoS₂/C-based HER electrocatalysts in 1.0 M KOH

Catalyst	$\eta_{10\text{mA cm}^{-2}}$ (mV)	Ref.
LiG/MoS₂	130	This work
Ni-MoS ₂ /rGO	168	[1]
MoS ₂ /rGO	225	
MoS ₂ -G-NiO@Ni	150	[2]
GQD/Co-MoS ₂	53	[3]
NiMoO ₄ -RGO	463	[4]
NiS ₂ /MoS ₂ -RGO	144	
0.2rGO-MoS ₂	314	[5]
Fe/C-doped-MoS ₂ /Ni ₃ S ₂ -450	188	[6]
NC@Mo ₂ C@MoS ₂ -(Ni)	216	[7]
DLHCs@NiS ₂ /MoS ₂ -8	230	[8]
5%-Ni-MoS ₂ /aCMT	140	[9]
MoS ₂ NSs/N-doped GR	208	[10]
S-MoS ₂ @C	155	[11]

References

- [1] C. Lin, Z. F. Gao, J. Jin, Boosting alkaline hydrogen evolution activity with Ni-doped MoS₂/reduced graphene oxide hybrid aerogel, *Chemosuschem*, 12 (2019), 457-466.
- [2] J. Yan, Y. Huang, L. Zhang, M. Zhou, P. Yang, W. Chen, X. Deng, H. Yang, J. Preparation of MoS₂-Graphene-NiO@Ni foam composite by sol coating for (photo)electrocatalytic hydrogen evolution reaction, *Sol-Gel Sci. Technol.* 93 (2020), 462-470.
- [3] J. Gong, Z. Zhang, S. Xi, W. Wang, J. Lu, P. Chen, Graphene quantum dot enabled interlayer spacing and electronic structure regulation of single-atom doped MoS₂ for efficient alkaline hydrogen evolution, *Chem. Eng. J.* 451 (2023), 138951.
- [4] L. N. Wang, T. Guo, S. Sun, Y. Wang, X. L. Chen, K. N. Zhang, D. X. Zhang, Z. H. Xue, X. B. Zhou, Tree-like NiS₂/MoS₂-RGO nanocomposites as pH universal electrocatalysts for hydrogen evolution reaction, *Catal. Lett.* 149 (2019), 1197-1210.
- [5] Y. Zhang, H. Zhou, H. Wang, Y. Zhang, D. D. Dionysiou, Synergistic effect of reduced graphene oxide and near-infrared light on MoS₂-mediated electrocatalytic hydrogen evolution, *Chem. Eng. J.* 418 (2021), 129343.
- [6] X. Lv, G. Liu, S. Liu, W. Chen, D. Cao, T. Song, N. Wang, Y. Zhu, Three-dimensional flower-like Fe, C-doped-MoS₂/Ni₃S₂ heterostructures spheres for accelerating electrocatalytic oxygen and hydrogen evolution, *Crystals*, 11

(2021), 340.

- [7] L. Gong, X. Mu, Q. Li, L. Ma, Y. Xiong, R. Li, Rational design of Ni-induced NC @Mo₂C@MoS₂ sphere electrocatalyst for efficient hydrogen evolution reaction in acidic and alkaline media, *Int. J. Hydrogen Energy*, 46 (2021), 5250-5258.
- [8] X. Luan, K. Zhu, C. Wang, W. Shi, A. Szymaska, K. Matras-Postolek, P. Yang, NiS₂/MoS₂ hetero-nanosheets grown on double-layered hollow carbon nanospheres for enhanced hydrogen evolution reaction, *Adv. Mater. Interfaces*, 9 (2022), 2201661.
- [9] Y. Xue, X. Bai, Y. Xu, Q. Yan, M. Zhu, K. Zhu, K. Ye, J. Yan, D. Cao, G. Wang, Vertically oriented Ni-Doped MoS₂ nanosheets supported on hollow carbon microtubes for enhanced hydrogen evolution reaction and water splitting, *Compos. B. Eng.* 224 (2021), 109229.
- [10] D. M. Nguyen, P. D. H. Anh, L. G. Bach, Q. B. Bui, Hierarchical heterostructure based on molybdenum dichalcogenide nanosheets assembled nitrogen doped graphene layers for efficient hydrogen evolution reaction, *Mater. Res. Bull.* 115 (2019), 201-210.
- [11] Q. C. Xu, Y. Liu, H. Jiang, Y. J. Hu, H. L. Liu, C. Li, Unsaturated sulfur edge engineering of strongly coupled MoS₂ nanosheet-carbon macroporous hybrid catalyst for enhanced hydrogen generation, *Adv. Energy Mater.* 9 (2019), 1802553.