Electronic Supplementary Material (ESI) for RSC Advances.

Electronic Supplementary Information

Gold micromeshes as highly active electrocatalysts for methanol oxidation reaction

Jingying Sun,[a] Feng Wang, [a] Yuan Liu, [a] Yizhou Ni, [a] Haiqing Zhou, [a] Chuan Fei Guo*[b], and Shuo Chen*[a]

a. Department of Physics & The Texas Center for Superconductivity, University of Houston, Houston, Texas 77204, United States. E-mail: schen34@uh.edu

b. Department of Materials Science & Engineering, South University of Science & Technology of China, Shenzhen, Guangdong 518055, China. E-mail: guocf@sustc.edu.cn

J.S., and F.W. contributed equally

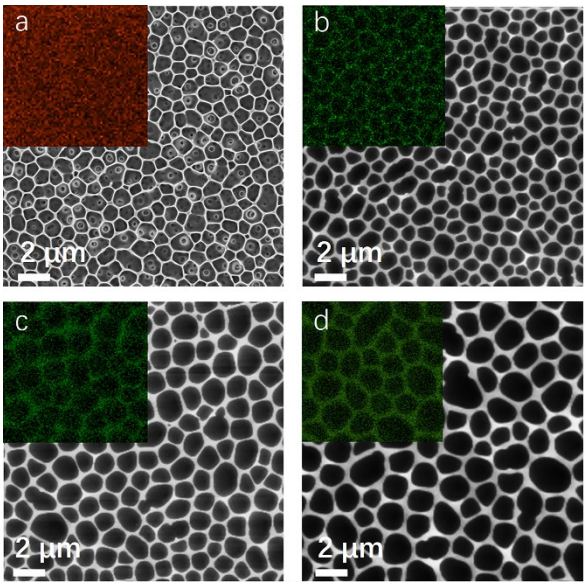

Fig. S1 SEM images and corresponding EDS mapping (insets) results of (a) PMMA template (map of C), (b) Am-1, (c) Am-1.5, and (d) Am-2 (maps of Au).

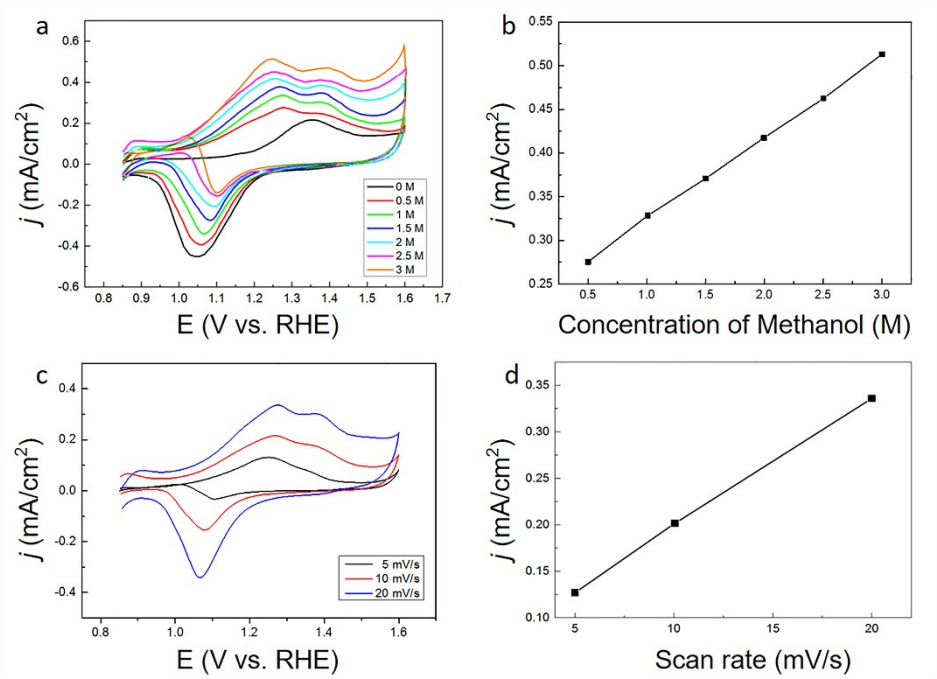

Fig. S2 (a) Electrochemical performances of sample Am-1 in 0.5 M KOH of different methanol concentration. (b) Curve of oxidation peaks vs. methanol concentrations. (c) Electrochemical performances of sample Am-1 in 0.5 M KOH and 1 M CH_3OH solution with different scan rates. (d) Curve of oxidation peaks vs. scan rates.

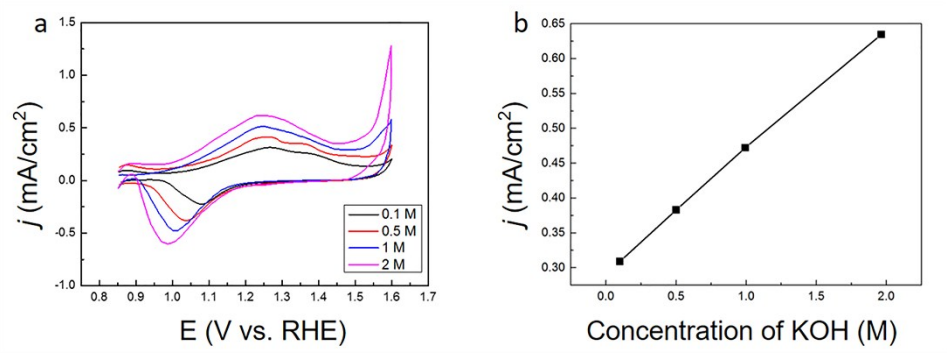

Fig. S3 (a)Electrochemical performances of sample Am-1 in 1 M methanol with different KOH concentrations. (b)Curve of oxidation peaks vs. KOH concentrations.

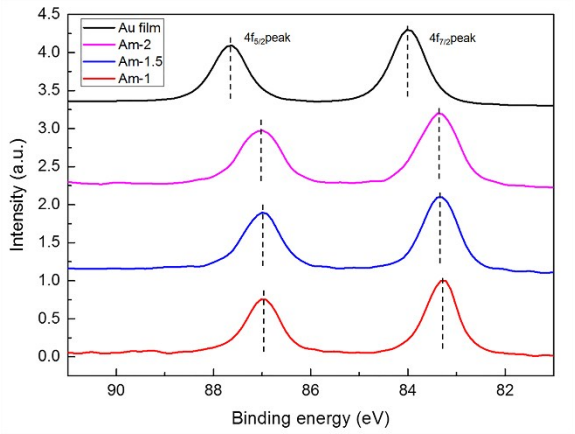

Fig. S4 XPS measurements of a continuous Au film, Am-1, Am-1.5, and Am-2.

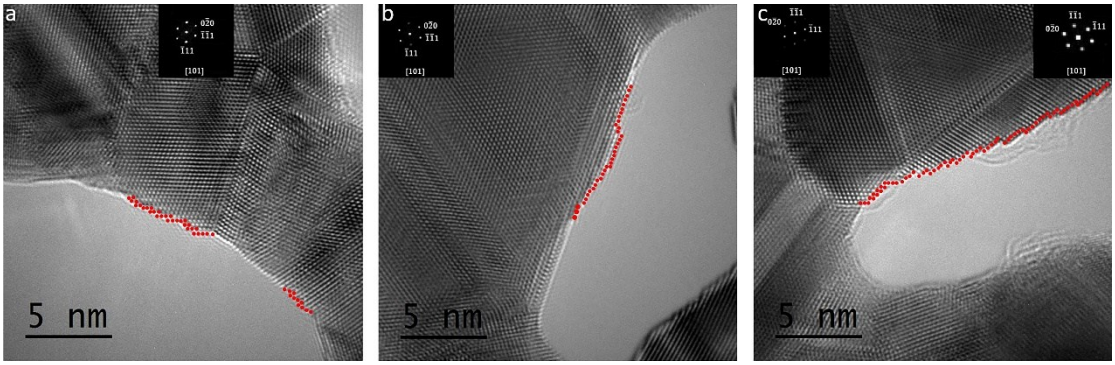

Fig. S5 Surface atomic structure of Au micromeshes samples. Typical HRTEM images and FFT of (a) Am-1, (b) Am-1.5., and (c) Am-2 samples.

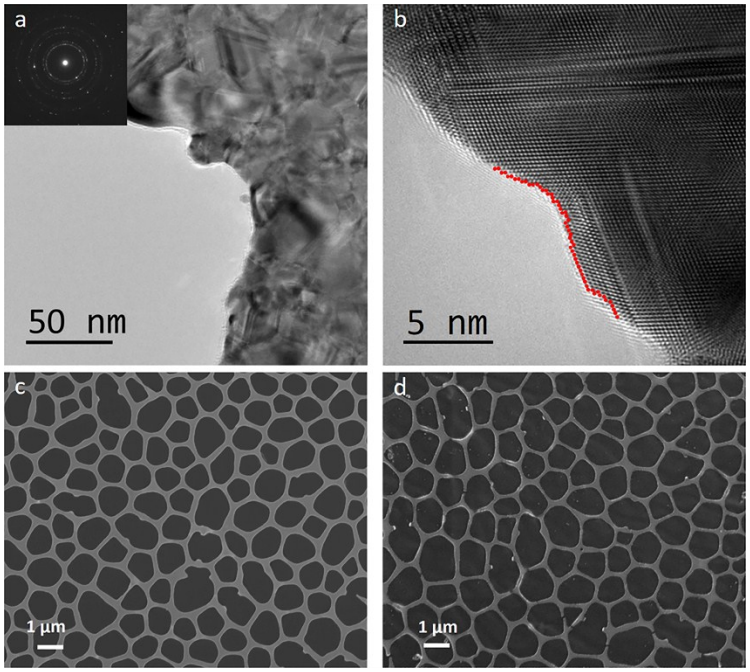

Fig. S6 Morphology change of Au micromeshes after cycling. (a), (b) TEM images of surface facets, and defects of sample Am-1 after 500 cycles. Pore and ligament sizes of sample Am-1 (c) before and (d) after 500 cycles.

Table S1. Comparison of electro-oxidation activity among Au nanostructures.

Catalyst	MOR peak current density (except background current) (mA/cm^2)	MOR peak potential (V vs RHE)	MOR onset potential (V vs RHE) (to 0.01 mA/cm^2)	Scan rate (mV/s)	Electrolyte	Reference
Au micromeshes/PDMS	0.264	1.26	0.85	20 mV/s	0.5 M KOH + 1 M CH_3OH	This work
Trisoctahedron Au nanocrystals	0.139	1.33	0.925	20 mV/s	0.5 M KOH + 1 M CH_3OH	1
Hollow nanoporous Au nanoparticles	0.112	1.27	0.966	20 mV/s	0.5 M KOH + 1 M CH_3OH	2
Nanoporous Au	0.081	1.30	0.870	20 mV/s	0.5 M KOH + 1 M CH_3OH	3
Nanoporous Au freestanding films	0.025	1.35	1.19	10 mV/s	0.1 M KOH + 1 M CH_3OH	4
Au dendrite	0.062	1.30	1.07	10 mV/s	0.1 M KOH + 1 M CH_3OH	5
Polycrystalline Au	0.035	1.33	1.157	10 mV/s	0.1 M KOH + 1 M CH_3OH	5
Dealloyed nanosponge Au particles	0.182	1.29	0.94	5 mV/s	0.5 M KOH + 1 M CH_3OH	6

References

1. Y. Song, T. Miao, P. Zhang, C. Bi, H. Xia, D. Wang and X. Tao, *Nanoscale*, 2015, **7**, 8405-8415.
2. S. Pedireddy, H. K. Lee, W. W. Tjiu, I. Y. Phang, H. R. Tan, S. Q. Chua, C. Troadec and X. Y. Ling, *Nat. Commun.*, 2014, **5**, 4947.
3. J. Zhang, P. Liu, H. Ma and Y. Ding, *J. Phys. Chem. C*, 2007, **111**, 10382-10388.
4. H. Xia, Y. Ran, H. Z. Li, X. Tao and D. Wang, *J. Mater. Chem. A*, 2013, **1**, 4678.
5. Y. Qin, Y. Song, N. Sun, N. Zhao, M. Li and L. Qi, *Chem. Mater.*, 2008, **20**, 3965–3972.
6. G. G. Li, Y. Lin and H. Wang, *Nano Lett.*, 2016, **16**, 7248-7253.