Electronic Supplementary Information

MoS_2 quantum dot-decorated MXene nanosheets as efficient hydrogen evolution electrocatalysts

Huajie Huang,† Ya Xue,† Yongshuai Xie, Ying Yang, Lu Yang, Haiyan He, Quanguo Jiang*, Guobing Ying*

College of Mechanics and Materials, Hohai University, Nanjing 210098, China

*E-mails: jiangqg@hhu.edu.cn or yinggb2010@126.com

Supplementary Results

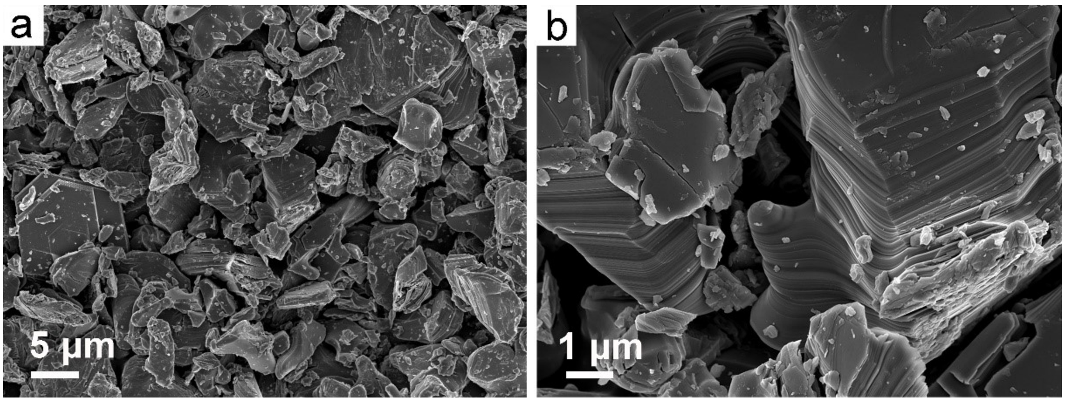

Fig. S1 Representative SEM image of bulk Ti_3AlC_2 at different magnifications.

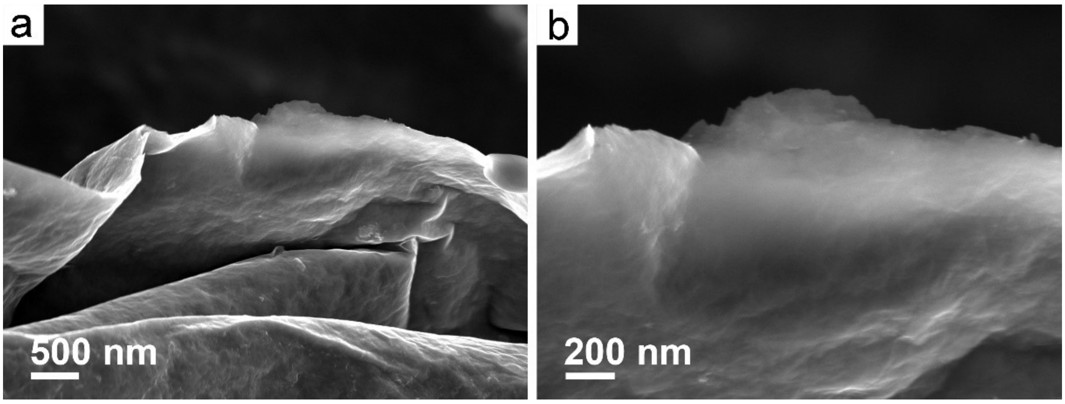

Fig. S2 Representative SEM image of 2D exfoliated $Ti_3C_2T_x$ at different magnifications.

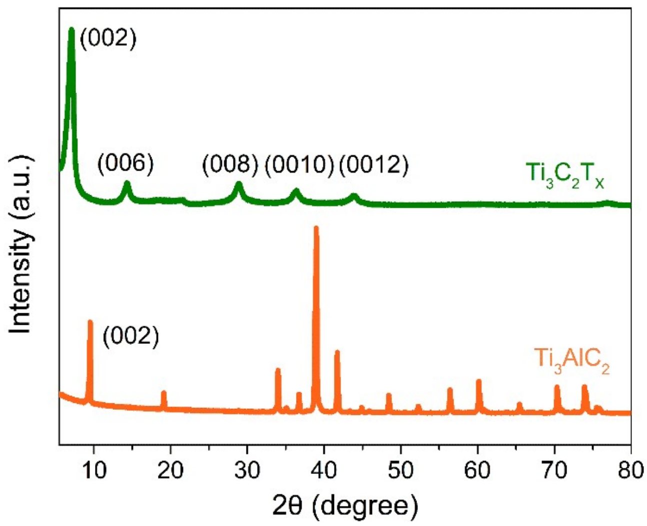

Fig. S3 Typical XRD patterns of $Ti_3C_2T_x$ nanosheets and Ti_3AlC_2 powder.

Fig. S4 The Tyndall phenomenon of the as-obtained $Ti_3C_2T_x$ MXene suspension.

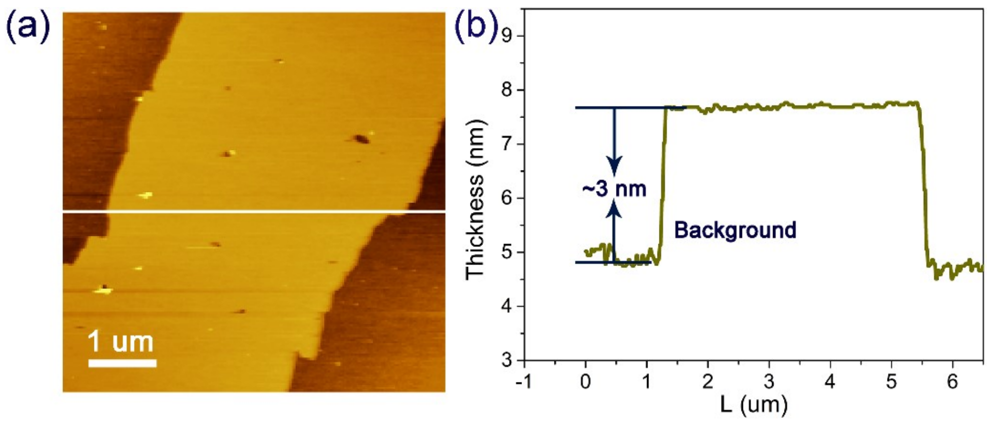

Fig. S5 (a) Representative AFM image of the $Ti_3C_2T_x$ MXene nanosheets. (b) The corresponding thickness analysis along the white lines displays that the uniform thickness of $Ti_3C_2T_x$ nanosheets is about 3 nm.

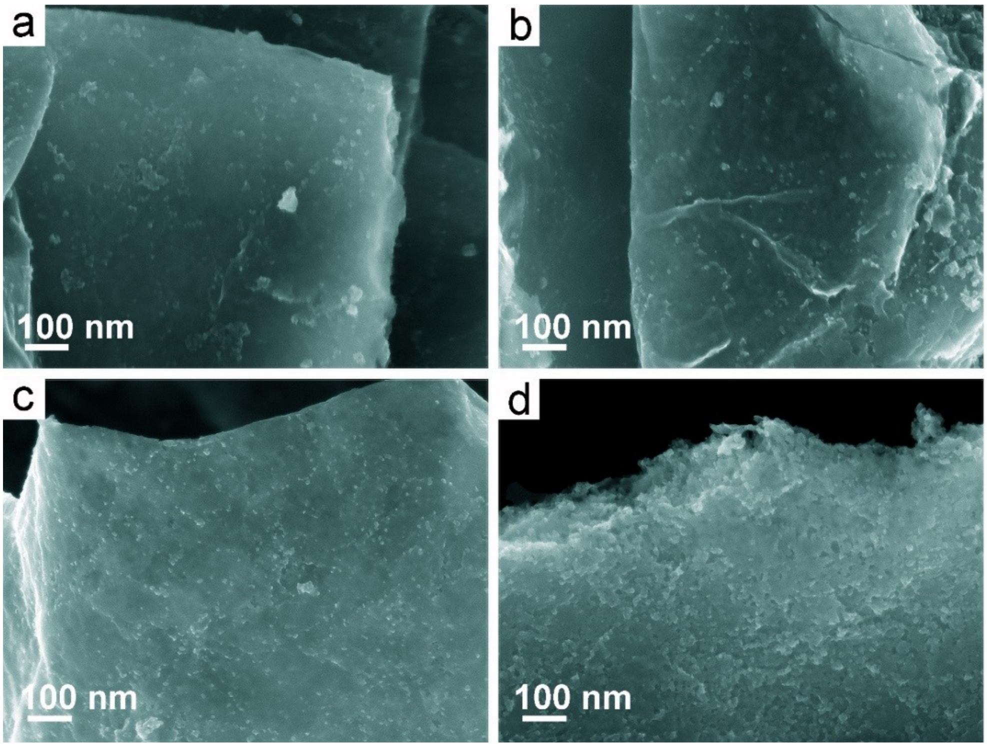

Fig. S6 Representative FE-SEM images of four ratios of (a) MQDs(1%)/$Ti_3C_2T_x$, (b) MQDs(3%)/$Ti_3C_2T_x$, (c) MQDs(5%)/$Ti_3C_2T_x$, and (d) MQDs(10%)/$Ti_3C_2T_x$ catalysts.

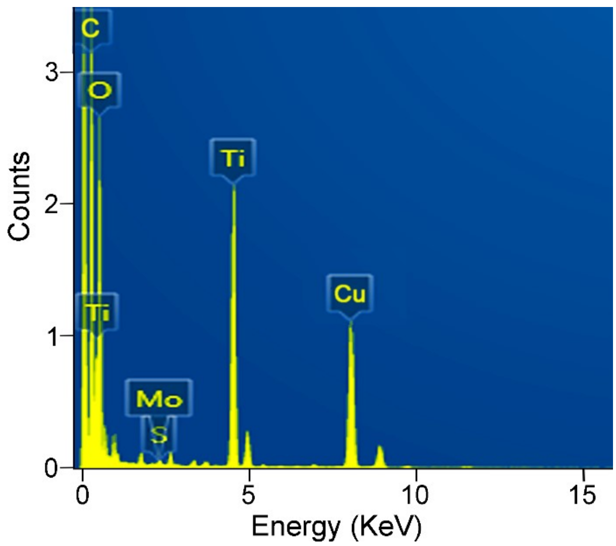

Fig. S7 EDX spectrum of the 2D MQDs/$Ti_3C_2T_x$ nanoarchitecture on copper mesh discloses the presence of Ti, C, Mo and S components in the composite.

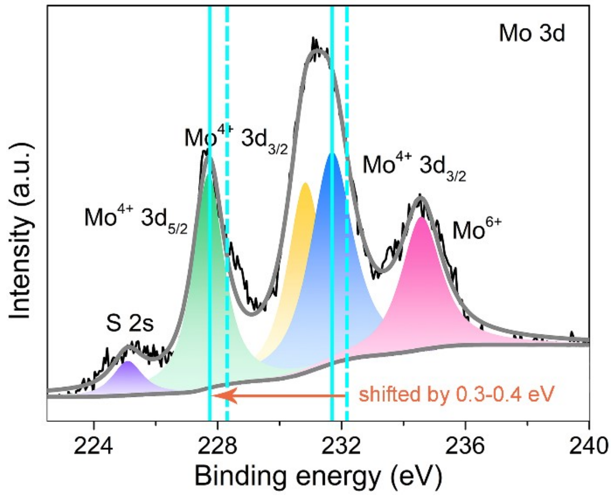

Fig. S8 High-resolution Mo 3d spectrum of MQDs(5%)/$Ti_3C_2T_x$, showing that the binding energies for Mo^{4+} peaks of MQDs(5%)/$Ti_3C_2T_x$ are shifted negatively compared with those of pure MoS_2.

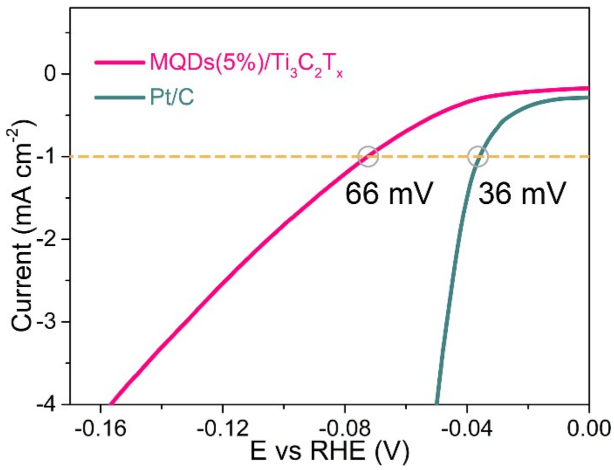

Fig. S9 LSV curves of MQDs(5%)/$Ti_3C_2T_x$ and Pt/C electrodes in 0.5 M H_2SO_4 solution.

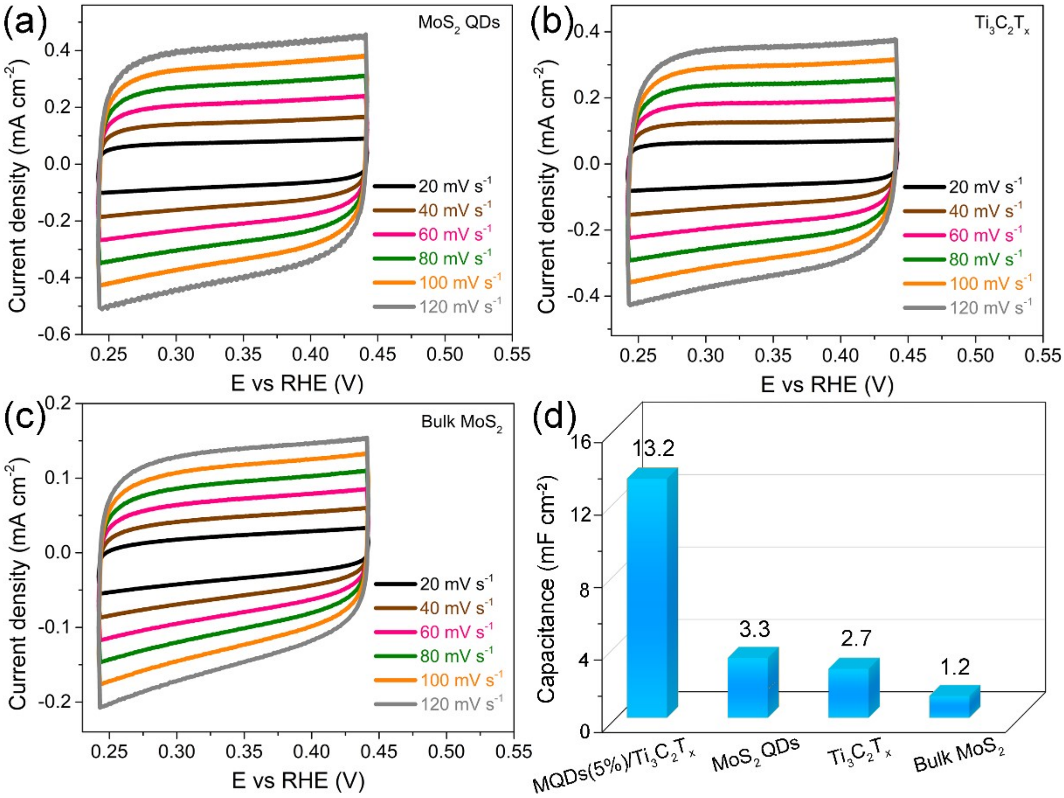

Fig. S10 The CV curves for (a) MoS_2 QDs, (b) $Ti_3C_2T_x$ and (c) bulk MoS_2 at potential from 0.24 V to 0.44 V (vs. RHE) at scan rates from 20 to 120 mV s^{-1}. (d) The specific C_{dl} values of MQDs(5%)/$Ti_3C_2T_x$, MoS_2 QDs, $Ti_3C_2T_x$ and bulk MoS_2.

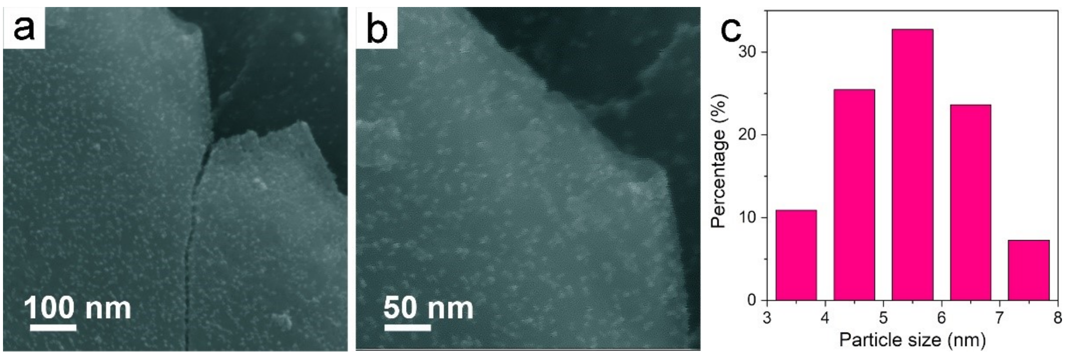

Fig. S11 Representative (a, b) FE-SEM images and (c) corresponding particle distribution of the MQDs(5%)/$Ti_3C_2T_x$ catalyst after the cycling test.

Table S1. Comparison of HER properties for the 2D MQDs/$Ti_3C_2T_x$ catalysts with those of the state-of-the-art MoS_2- and $Ti_3C_2T_x$-based catalysts.

Type of electrocatalyst	Electrolyte	Onset potential (mV)	Tafel slope (mV dec^{-1})	Ref.
MQDs(5%)/$Ti_3C_2T_x$	0.5 M H_2SO_4	66	74	This work
MoS_2/C	0.5 M H_2SO_4	~80	78	S1
MoS_2/CNTs	0.5 M H_2SO_4	~130	87	S2
$MoSe_2$/$Ti_3C_2T_x$	0.5 M H_2SO_4	61	91	S3
RGO aerogel/$Ti_3C_2T_x$	0.5 M H_2SO_4	~70	130	S4
MoS_2/g-C_3N_4/RGO	0.5 M H_2SO_4	170	79	S5
Co_4S_3/N-doped C/MoS_2	0.5 M H_2SO_4	~120	82	S6
Co_9S_8/MoS_2/CNFs	0.5 M H_2SO_4	N.A.	110	S7
Pt/$Ti_3C_2T_x$	0.5 M H_2SO_4	N.A.	79	S8
$Ti_3C_2T_x$ nanofibers	0.5 M H_2SO_4	~100	97	S9

References

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