Electronic Supplementary Material (ESI) for Journal of Materials Chemistry A

High Photoelectrocatalytic Performance of MoS_2/SiC Hybrid Structure for Hydrogen Evolution Reaction

Xiaoning Guoa, Chengmeng Chena, Yunwei Wanga,b, Xili Tonga, Guoqiang Jina, and Xiang-Yun Guoa,*

[a] State Key Laboratory of Coal Conversion, Institute of Coal Chemistry, Taiyuan 030001, PR China

[b] University of the Chinese Academy of Sciences, Beijing 100039, PR China

*Corresponding author:

Fax/Tel: +86-351 4065282

Email: xyguo@sxicc.ac.cn (X. Y. Guo)

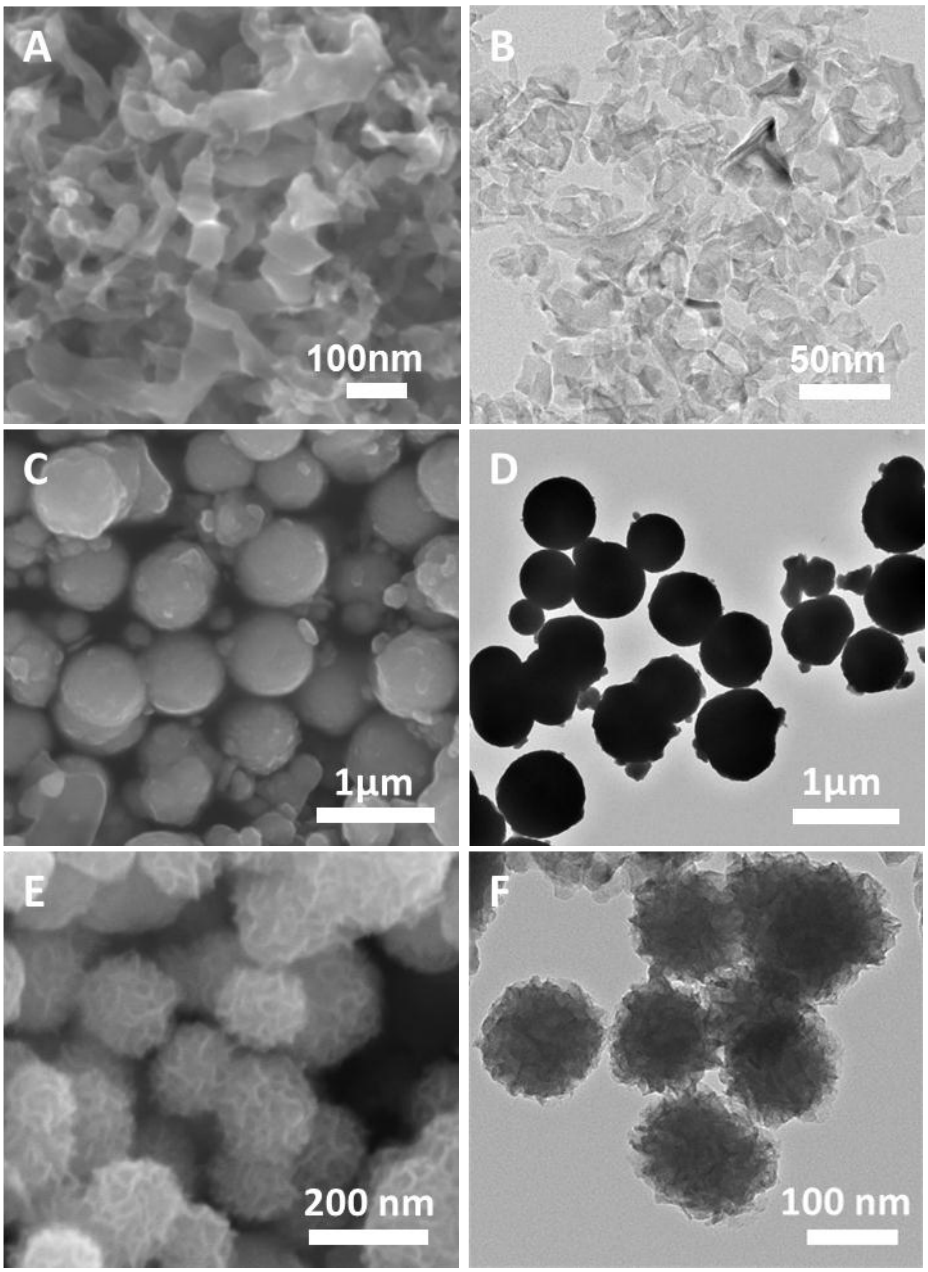

Fig. S1. SEM and TEM images of SiC nanosheets before (A) and after (B) etching, free MoS_2 (C, D) and the MoS_2/SiC hybrid (E, F). The free MoS_2 are 3D-like spherical particles and their surfaces are almost smooth, whereas the MoS_2/SiC hybrid is composed of uniformly flower-like spheres assembled by folded flakes with thickness of about several nanometers.

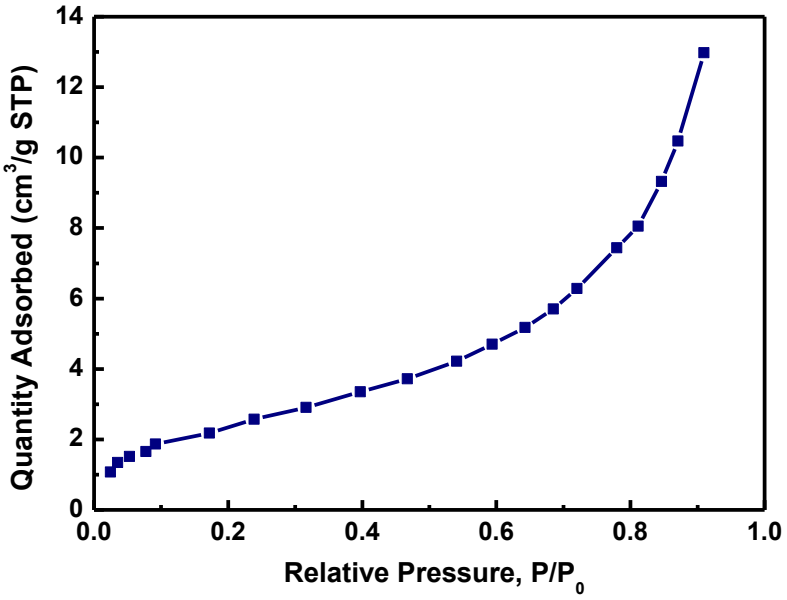

Fig. S2. Adsorption isotherm of p-xylene vapor on the MoS_2/SiC hybrid. The equilibrium adsorption value is only 13.0 cm^3/g, which is far less than the value for water vapor (104.6 cm^3/g), indicating that the nanopores in the hybrid catalyst are strongly favorable to the adsorption of H_2O molecules.

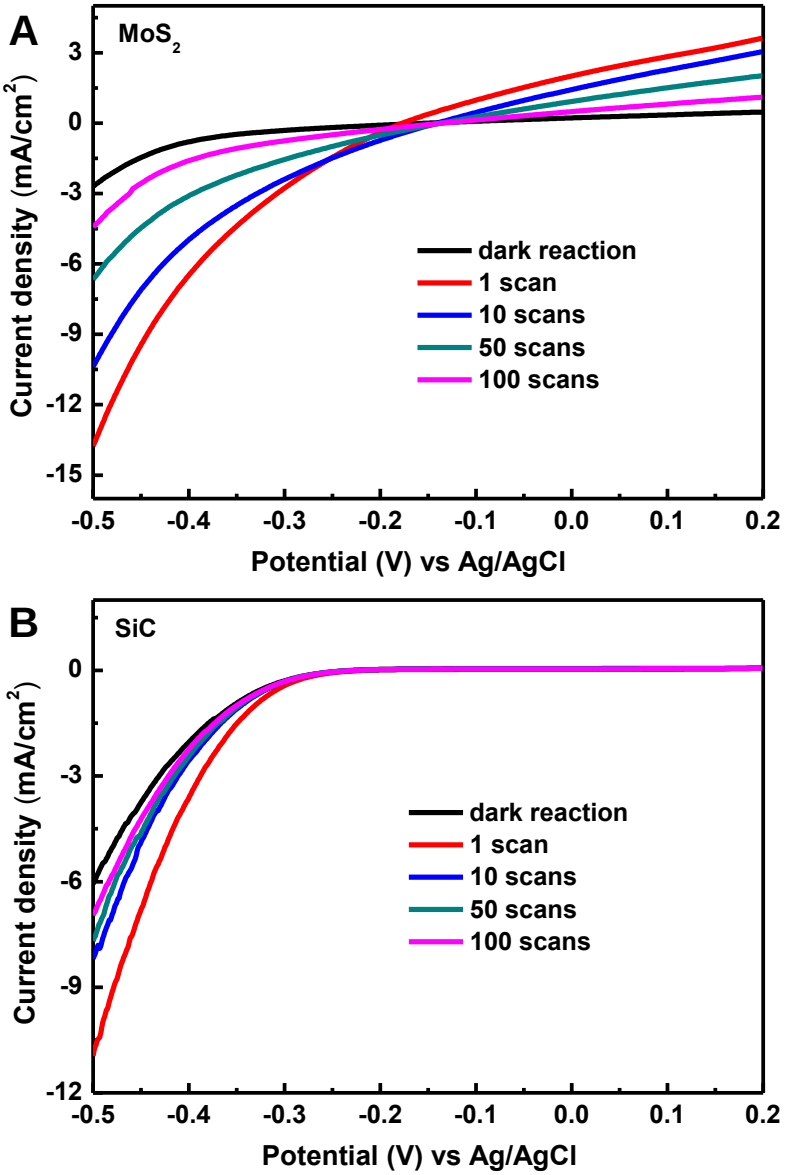

Fig. S3. The photoelectric conversion efficiency and catalytic stability of free MoS_2 and SiC. Both MoS_2 and SiC can effectively response visible light and generate photocurrent. However, MoS_2 and SiC showed a high overpotential (η) of about 0.2 and 0.32 V at the first scan for HER, suggesting that their catalytic activities are less than the MoS_2/SiC (0.04V). Meanwhile, either MoS_2 or SiC shows poor catalytic stability, and the current density rapidly decreases with the scan times.

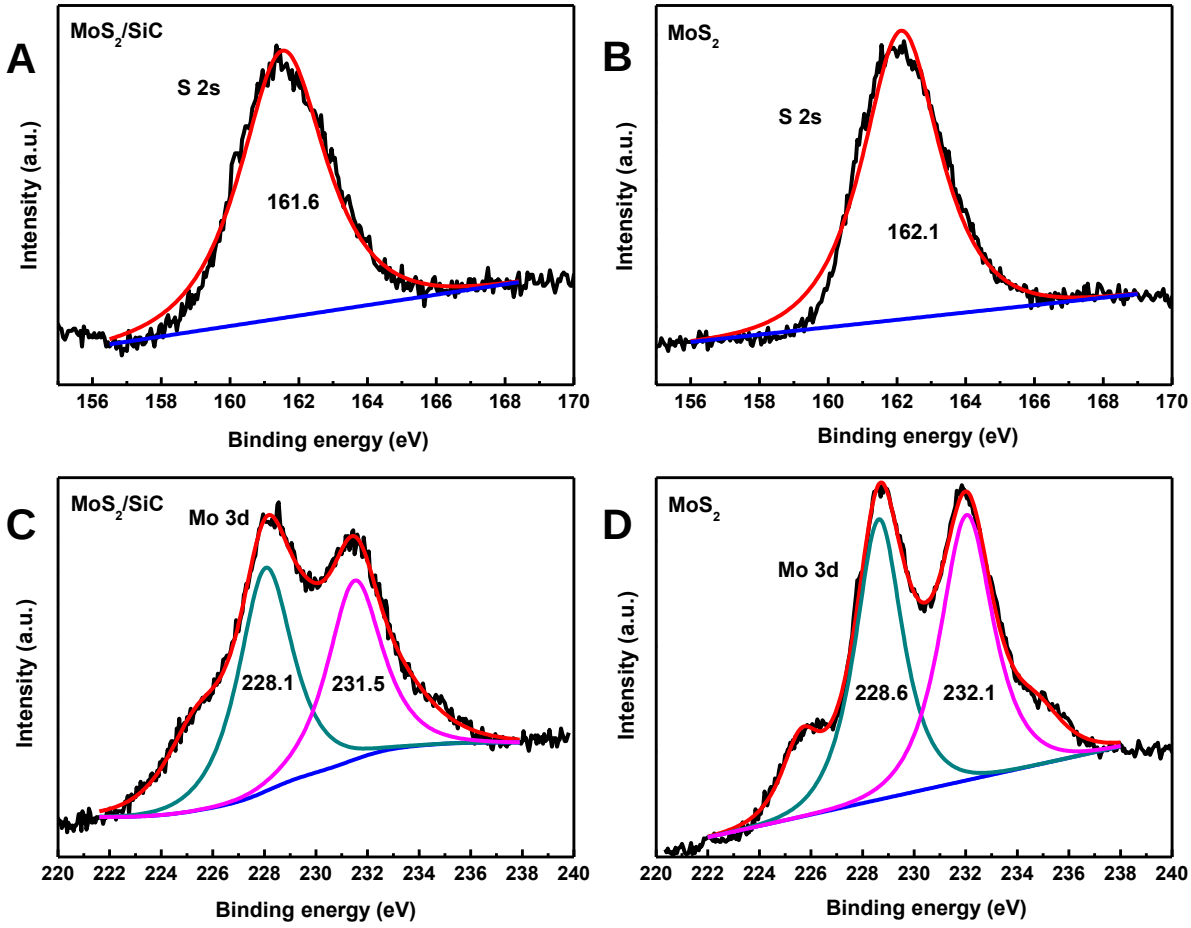

Fig. S4. XPS spectra of S_{2s} (A and B) and Mo_{3d} (C and D) levels of the MoS_2/SiC hybrid and free MoS_2 particles. Both the S_{2s} and Mo_{3d} BE values of MoS_2/SiC are lower than those of free MoS_2, suggesting that electron cloud densities around those atoms increase.

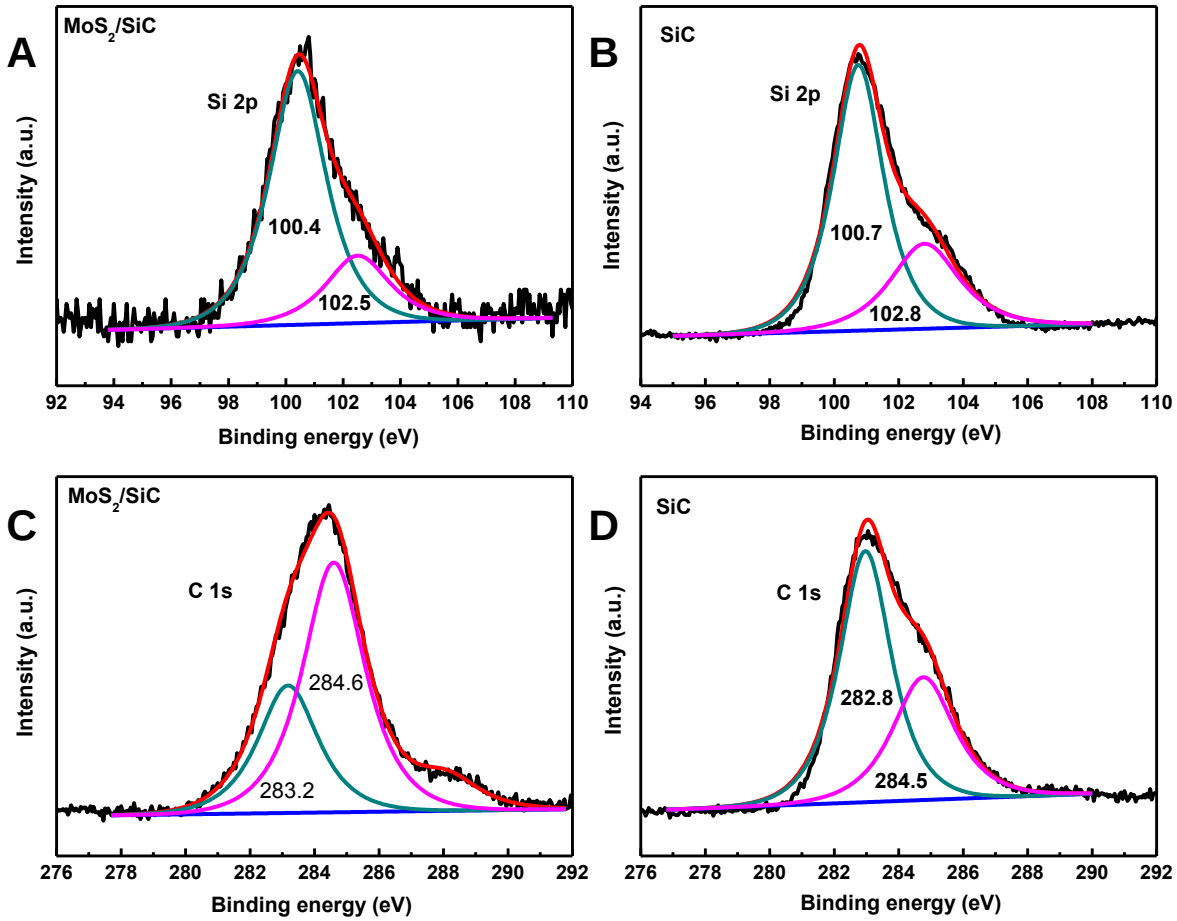

Fig. S5. XPS spectra of Si_{2p} (A and B) and C_{1s} (C and D) levels of the MoS_2/SiC hybrid and free SiC. The Si_{2p} BE value of MoS_2/SiC is lower than that of free SiC, suggesting that the electron cloud density around Si increases. While the C_{1s} peaks in the MoS_2/SiC shift to higher binding energies comparing with free SiC, indicating that the surrounding electrons of C have transferred to other atoms.