

# Pristine and Platinum-deposited metallic Molybdenum ditelluride for Hydrogen Evolution Reaction

Jinbong Seok, Jun-Ho Lee, Byungdo Ji, Young-Woo Son, Suyeon Cho and Young Hee Lee, Heejun Yang

Jinbong Seok, Byungdo Ji, Prof. Young Hee Lee, Prof. Heejun Yang

Department of Energy Science, Sungkyunkwan University, Suwon 16419, Korea.

Jinbong Seok, Prof. Young Hee Lee

IBS Center for Integrated Nanostructure Physics (CINAP), Institute for Basic Science, Sungkyunkwan University, Suwon 16419, Korea.

Dr. Jun-Ho Lee, Prof. Young-Woo Son

Korea Institute for Advanced Study, Seoul 02455, Korea.

Prof. Suyeon Cho

Division of Chemical Engineering and Materials Science, Ewha Womans University, Seoul 03760, Korea.

*h.yang@skku.edu, s.cho@ewha.ac.kr*

## 1. Abstract

Electrochemical catalysts based on transition metal dichalcogenides (TMDs) have been intensively studied in hydrosulfurization, hydrogenation, and the hydrogen evolution reaction (HER) [1-3]. Moreover, TMDs have polymorphism, which has stimulated extensive studies on tuning of surface electronic structures for active HER. The polymorphism in TMDs provides an opportunity for new hybrid catalysts with TMDs and other catalytic metals via surface engineering that can create novel facets of the catalytic metals for active HER. Here, we report a hybrid catalyst with monoclinic MoTe<sub>2</sub> and platinum (Pt) for the HER. Pt atoms were decorated on the surface of monoclinic MoTe<sub>2</sub> that has an atomically-distorted lattice structure, which produces a distinct Pt-Te alloy layer. The Pt/MoTe<sub>2</sub> hybrid catalyst exhibits an active HER with a Tafel slope of 22 mV per decade and an exchange current density of 1.0 mA/cm<sup>2</sup>, which are the best values among those reported for TMD-based catalysts. The decoration of catalytic metals on atomically-distorted metallic TMDs realizes rich catalytic active sites on large basal planes for efficient hydrogen production.

## 2. Figures and tables

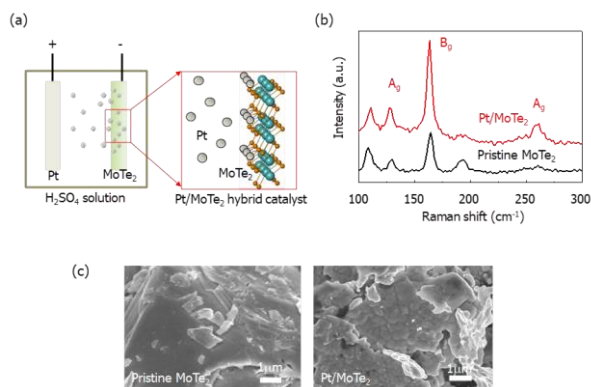


Figure 1: Preparation of Pt/MoTe<sub>2</sub> hybrid catalyst a) Schematic picture b) Raman spectra c) Scanning electron microscope (SEM) images

## 3. References

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- [3] M. Chhowalla, H.S. Shin, G. Eda, L.-J. Li, K.P. Loh, H. Zhang, *Nat. Chem.*, 5 (2013) 236