

Supplementary Information

Layered Nanocomposites of Polymer-Functionalized Reduced Graphene Oxide and Borocarbonitride with MoS₂ and MoSe₂ and Their HER activity

K. Pramoda, Swaraj Servottam, Manjodh Kaur and C. N. R. Rao*

New Chemistry Unit, Chemistry and Physics of Materials Unit, School of Advanced Materials, International Centre for Material Science and Sheikh Saqr Laboratory, Jawaharlal Nehru Centre for Advanced Scientific Research (JNCASR), Jakkur P. O., Bangalore 560064, India

*E-mail: cnrrao@jncasr.ac.in

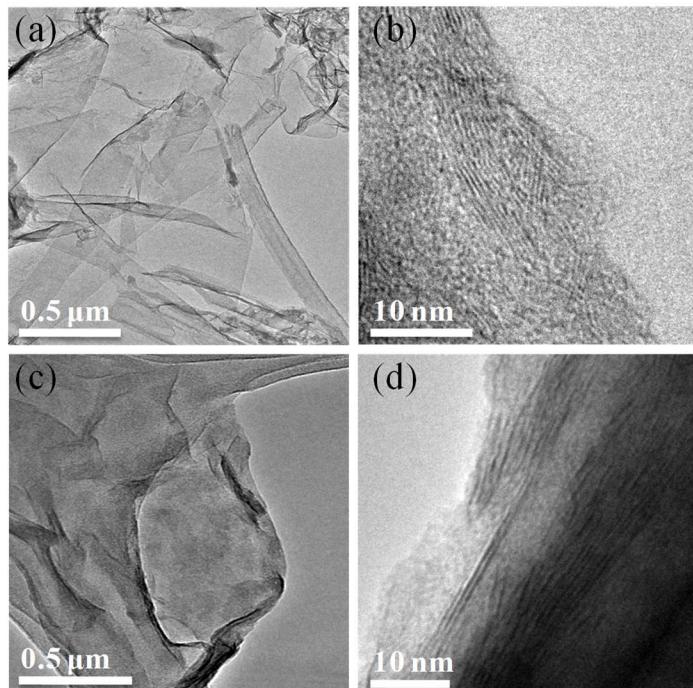


Figure S1. (a) TEM and (b) HRTEM image of graphene oxide; (c) TEM and (d) HRTEM image of exfoliated MoS₂.

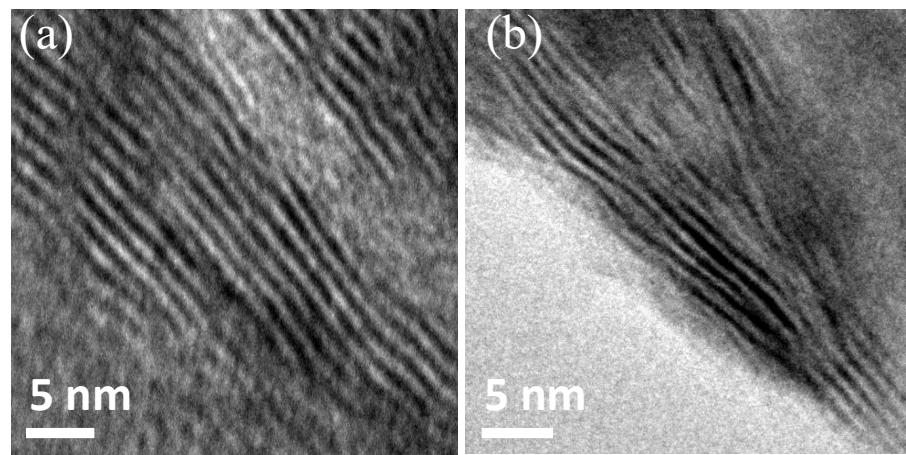


Figure S2. HRTEM images of (a) P.RGO-MoS₂ (1:3) and (b) P.BCN-MoS₂ (1:3) nanocomposites.

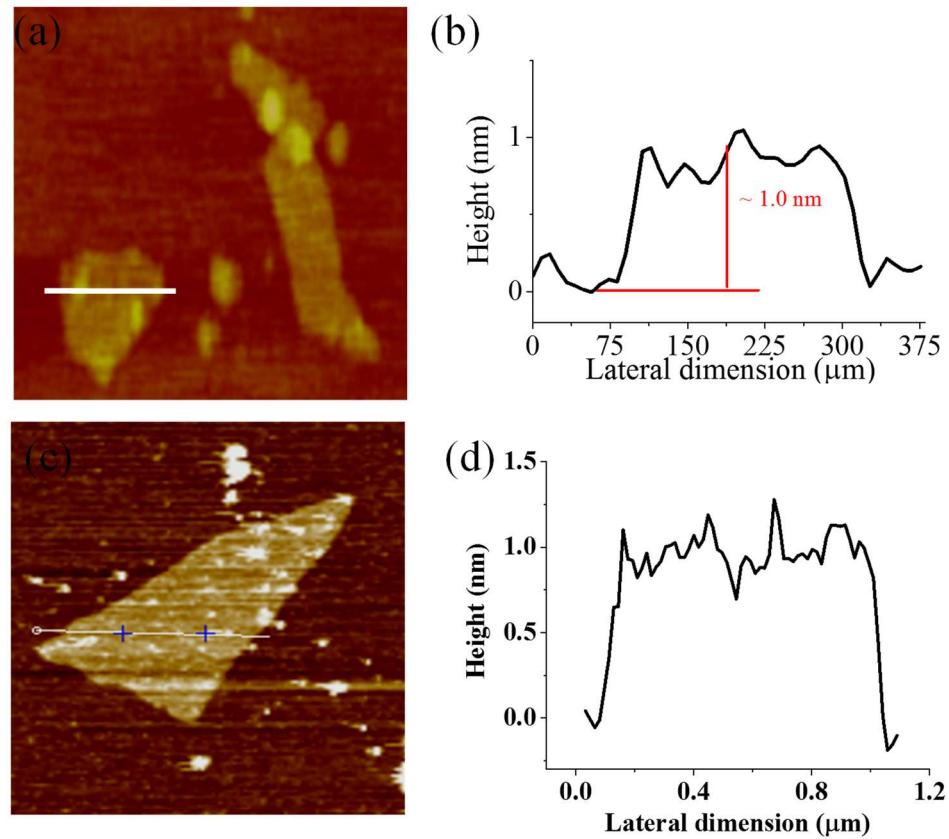


Figure S3. AFM image and Step height profile of (a, b) P.RGO and (c, d) P.BCN.

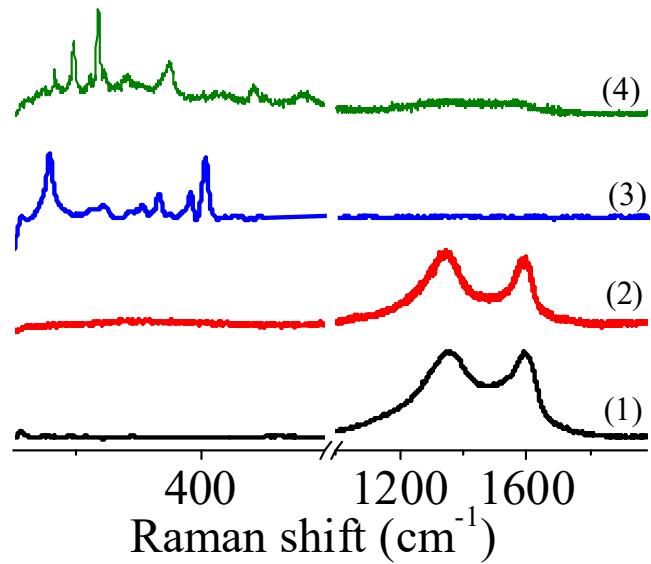


Figure S4. Raman spectra of (a) (1) P.RGO, (2) P.BCN (3) Exfoliated MoS₂, (4) Exfoliated MoSe₂.

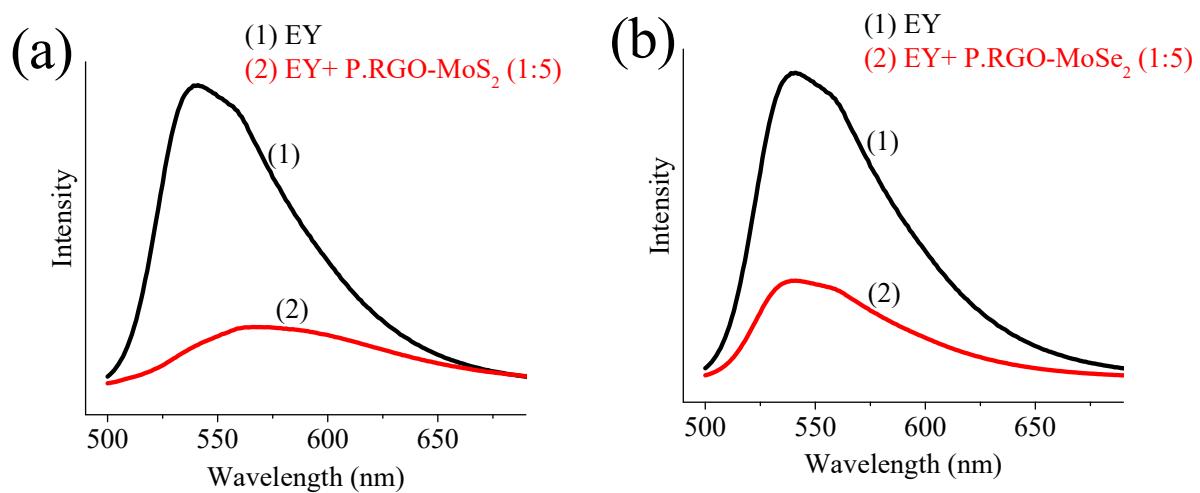


Figure S5. (a) and (b) Photoluminescence spectra of aqueous solution of eosin Y (1.0×10^{-7} M, excitation wavelength = 490 nm) in the presence of P.RGO-MoS₂ (1:5) and of P.RGO-MoSe₂ (1:5) respectively.

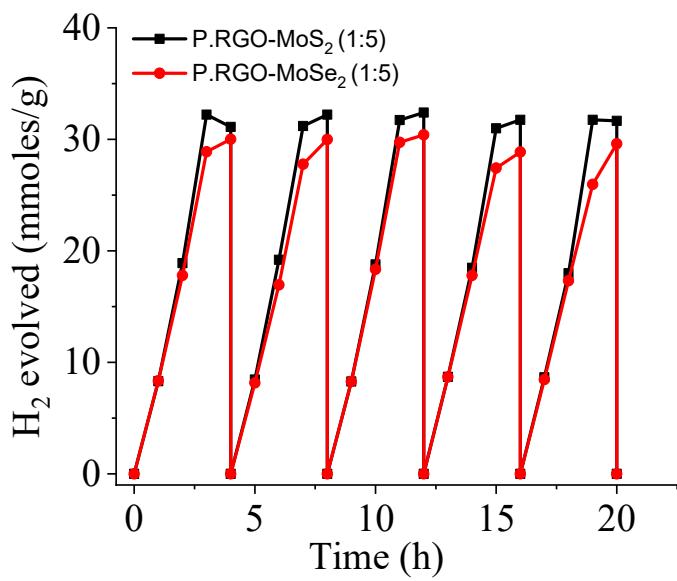


Figure S6. Cyclic stability curves of P.RGO-MoS₂ (1:5) and of P.RGO-MoSe₂ (1:5) nanocomposites.

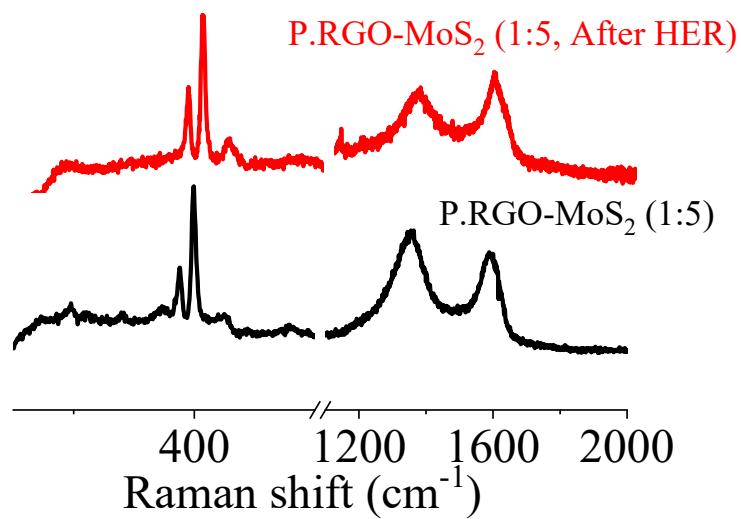


Figure S7. Raman spectra of as synthesized P.RGO-MoS₂ (1:5) and (b) Raman spectra of P.RGO-MoS₂ (1:5) recorded after HER studies.

Table S1. Zeta potential values of P.RGO-MoS₂, P.RGO-MoSe₂ and P.BCN-MoS₂ nanocomposites.

Compound	Zeta Potential (mV)
GO	-33.7
BCN	-8.0
P.RGO	+56.4
P.BCN	+51.3
Exfoliated MoS ₂	-48.3
Exfoliated MoSe ₂	-46.8
P.RGO-MoS ₂ (1:5)	-4.8
P.RGO-MoSe ₂ (1:5)	-2.6
P.BCN-MoS ₂ (1:5)	-13.7

Table S2. Photochemical HER data of superlattice-like nanocomposites.

Compound	H ₂ Evolved (μmol h ⁻¹ g ⁻¹)	Compound	H ₂ Evolved (μmol h ⁻¹ g ⁻¹)
P.RGO	254	P.RGO-MoSe ₂ (1:1)	3512
P.BCN	865	P.RGO-MoSe ₂ (1:3)	4984
2H-MoS ₂	1344	P.RGO-MoSe ₂ (1:5)	9540
2H-MoSe ₂	2122	P.RGO-MoSe ₂ (1:7)	8966
P.RGO-MoS ₂ (1:1)	3862	P.RGO-MoSe ₂ (1:9)	9705
P.RGO-MoS ₂ (1:3)	5612	P.BCN-MoS ₂ (1:3)	4488
P.RGO-MoS ₂ (1:5)	11230	P.BCN-MoS ₂ (1:5)	8593
P.RGO-MoS ₂ (1:7)	10801	P.BCN-MoS ₂ (1:7)	8992
P.RGO-MoS ₂ (1:9)	10338		

Table S3. Electrochemical H₂ evolution data of MoS₂, P.BCN and P.BCN-MoS₂ nanocomposites.

Compound	Onset potential (V) vs RHE	Tafel slope (mV/decade)
MoS ₂	-0.19	77
P.BCN	-0.47	183
Pt/C	-0.01	37
P.BCN-MoS ₂ (1:3)	-0.14	94
P.BCN-MoS ₂ (1:5)	-0.05	65
P.BCN-MoS ₂ (1:7)	-0.08	70