Electronic Supporting Information

Highly Proton Conducting MoS_2/Graphene oxide Nano-composite based Chemoresistive Humidity Sensor†

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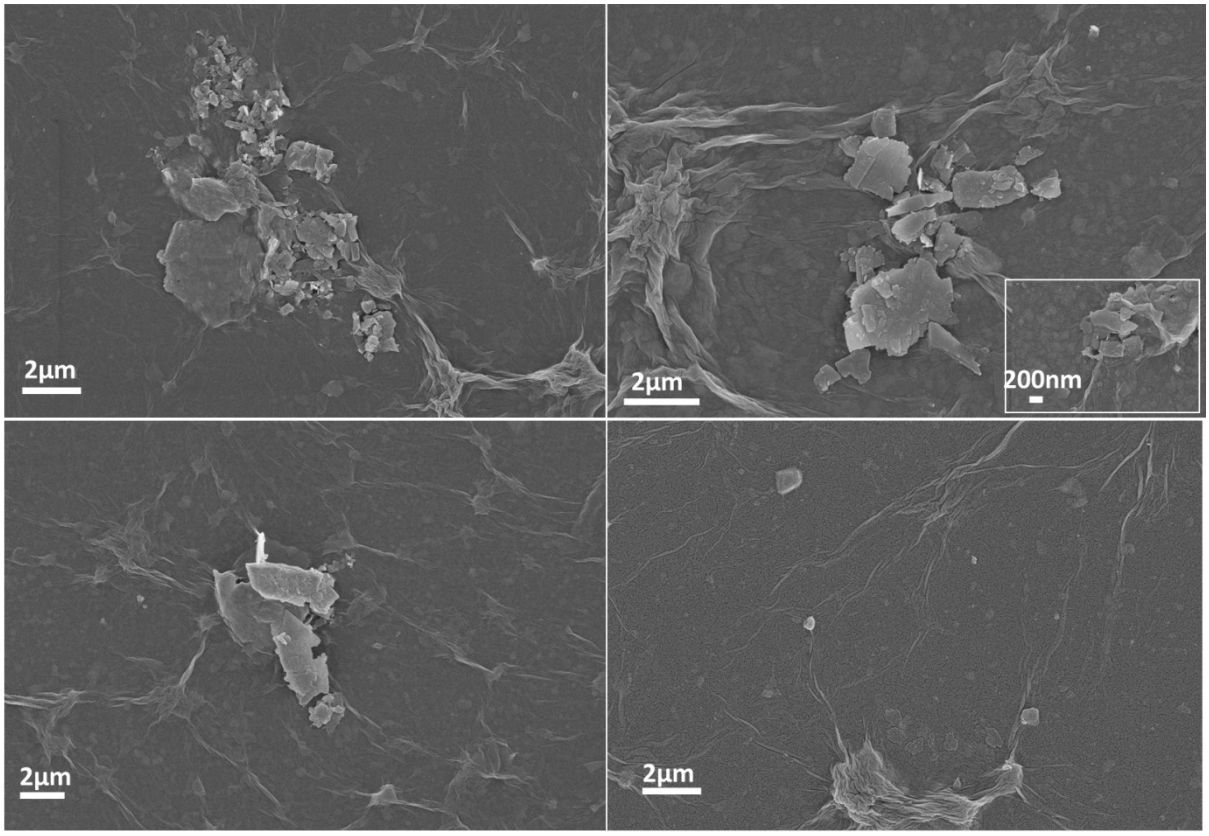

Figure S1: SEM images of MoS2/GO composites (a) 1:0.5 (b) 1:4 (c) 1: 6 (d) 1:8.

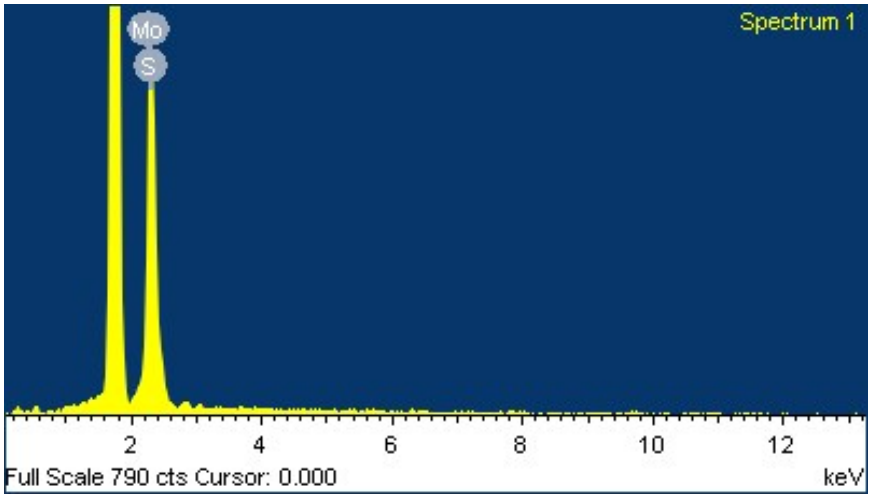

Figure S2: EDAX of 8 hours sonicated MoS_2 flakes.

Table S1: EDAX of MoS_2 nanoflakes.

Element	Weight %	Atomic %
S K	33.86	60.50
Mo L	66.14	39.50

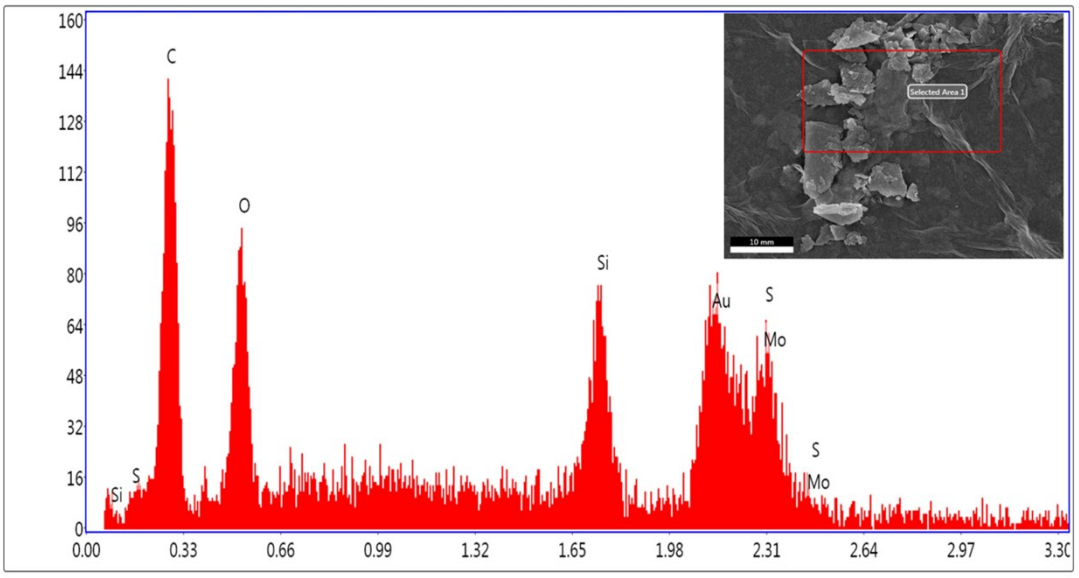

Figure S3: EDAX of MoS_2/GO 1:4 composite.

Table S2: EDAX of MoS_2/GO 1:4 composite.

Element	Weight %	Atomic %
C K	16.55	48.50
O K	6.61	14.53
SiK	9.63	12.06
AuM	41.97	7.50
MoL	14.07	5.16
S K	11.17	12.26

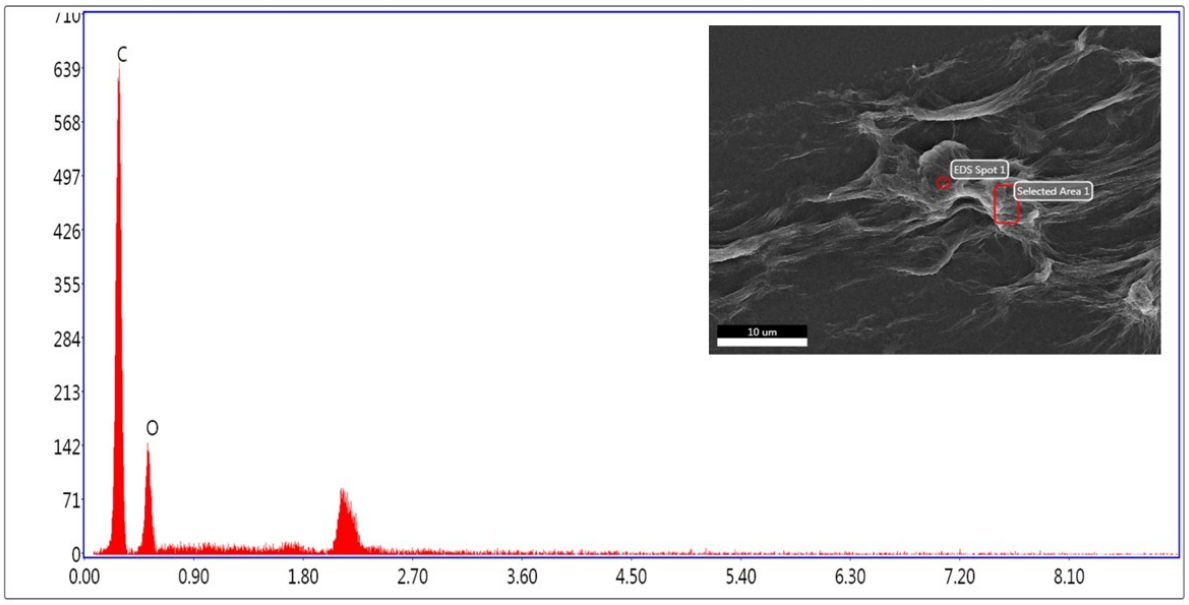

Figure S4: EDAX of GO sheets.

Table S3: EDAX of GO sheets.

	Element	Weight %	Atomic %
	C K	72.82	78.11
	O K	27.18	21.89

The XPS characterisation was carried out for the 2 hours and 8 hours sonicated sample to investigate the presence of S-vacancies in the samples. The XPS spectra were calibrated with the C 1s peak at 284.5 eV as reference. The small peak at 226.3 eV characterizes the S 2s peak. The Mo^{4+} $3d_{5/2}$ and $3d_{3/2}$ peaks were de-convoluted into two sets of components–the first one being located at 229.23 eV and 232.26 eV and the second set located at 228.87 eV and 231.9 eV . The first set of components corresponds to intrinsic MoS_2 (i-MoS_2) and the second set, at a slightly lower binding energy shows the presence of defective MoS_2 (d-MoS_2) with sulphur (S) vacancies[1, 2, 3]. It was also observed that with increase in sonication time from 2 hours to 8 hours, the intensity of d-MoS_2 increases. So it can be concluded that

the number of S-vacancy sites increased with increase in sonication time as the d-MoS_2 peaks were directly associated with S-vacancies [2].

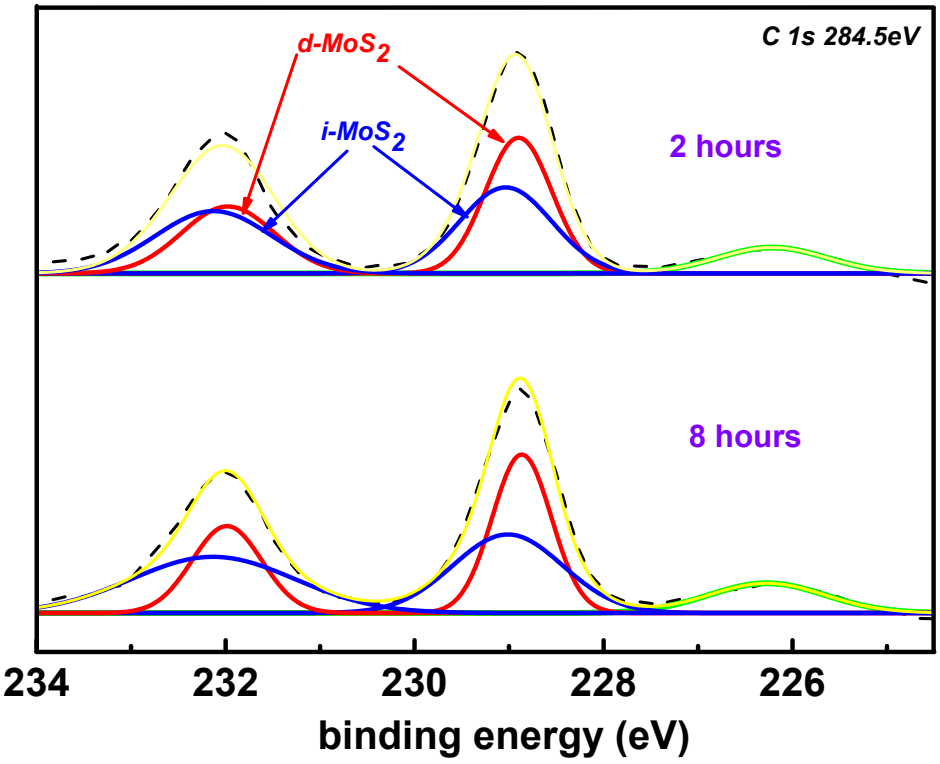

Figure S5: Mo-3d XPS spectra of 2 hours and 8 hours sonicated MoS_2 samples.

The poor response of the 12 hours sonicated sample can be attributed to the agglomeration of the nanoflakes (Figure S6) due to the high energy generated during sonication.

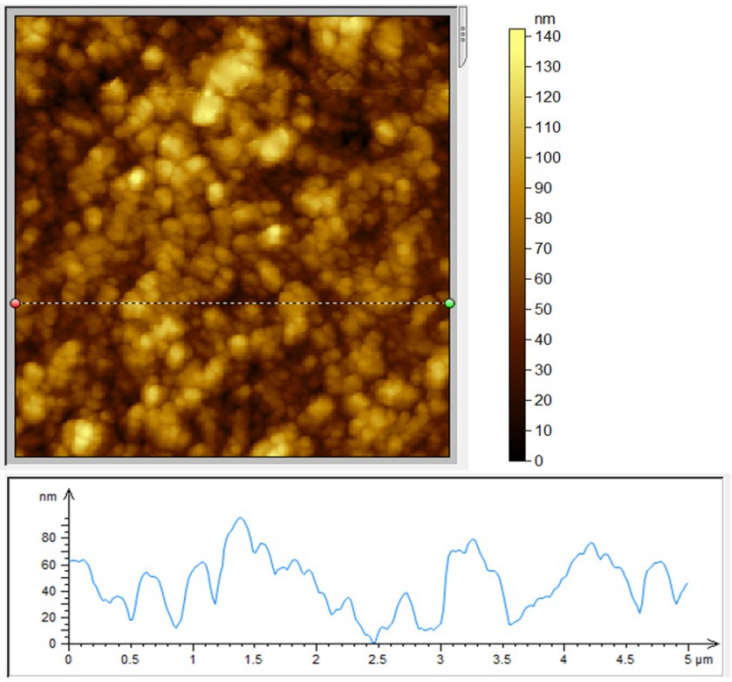

Figure S6: AFM image of 12 hours sonicated MoS_2 sample showing agglomeration

REFERENCES

1. D. M. Sim, M. Kim, S. Yim, M.-J. Choi, J. Choi, S. Yoo and Y. S. Jung, *ACS Nano*, 2015.
2. I. S. Kim, V. K. Sangwan, D. Jariwala, J. D. Wood, S. Park, K.-S. Chen, F. Shi, F. Ruiz-Zepeda, A. Ponce, M. Jose-Yacaman, V. P. Dravid, T. J. Marks, M. C. Hersam and L. J. Lauhon, *ACS Nano*, 2014, **8**, 10551-10558.
3. M. Quan, M. O. Patrick, M. John, L. Duy, S. W. Chen, Z. Yeming, C. Tianyang, S. Dezheng, Y. Koichi, T. Tai, W. Michelle, L. M. Jessica, W. Jonathan, M. KatieMarie, F. H. Tony, S. R. Talat, K. Roland and B. Ludwig, *Journal of Physics: Condensed Matter*, 2013, **25**, 252201.