



Supplementary Data

High-Performance Humidity Sensor Based on the Graphene Flower/Zinc Oxide Composite

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Figure 1. is showing the microscopic image of screen-printed interdigitated electrodes that confirms the finger width of $40\mu\text{m}$ and distance between two fingers is $60\mu\text{m}$. On right side printed IDE's camera picture is depicted.



Figure S1. Microscopic and camera image of screen-printed interdigitated electrodes.

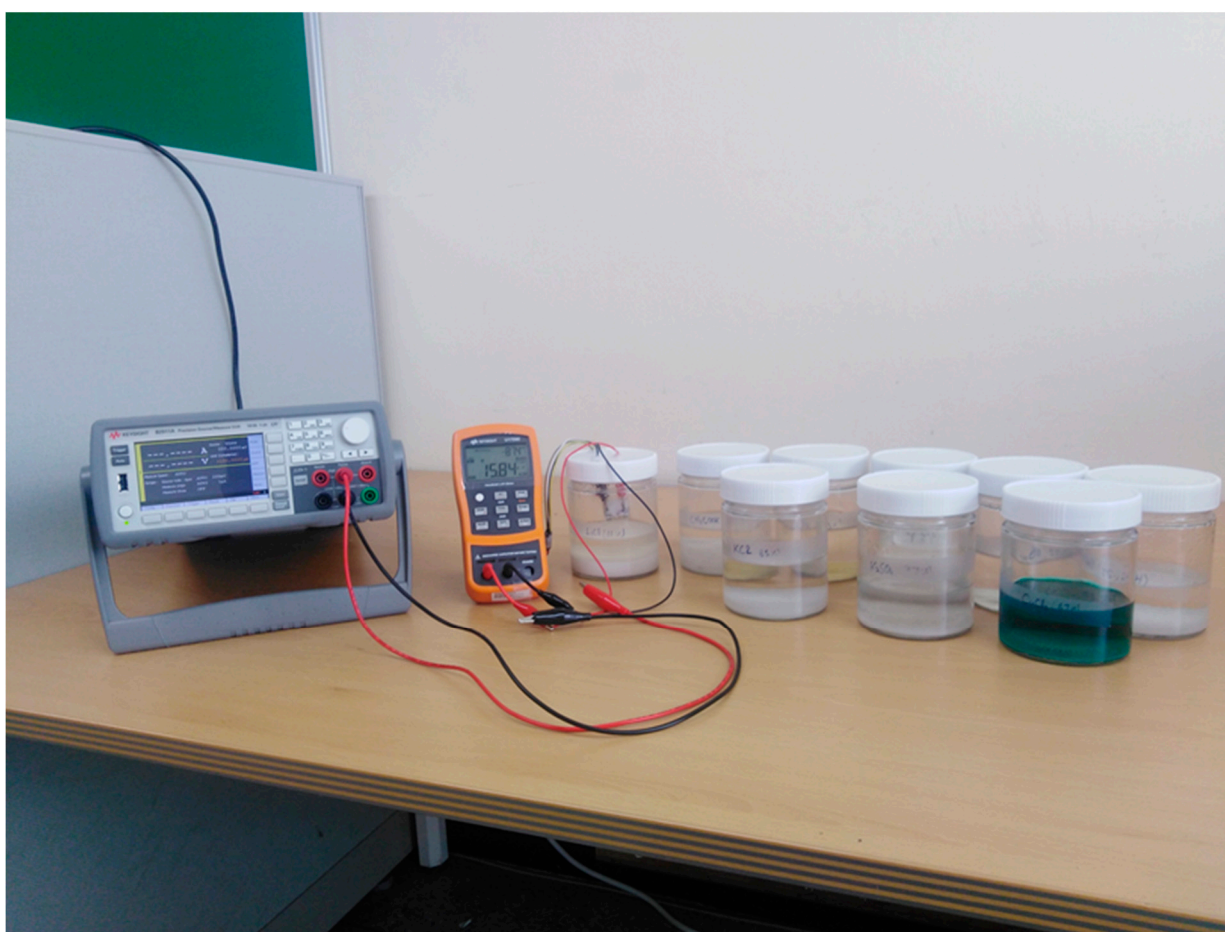
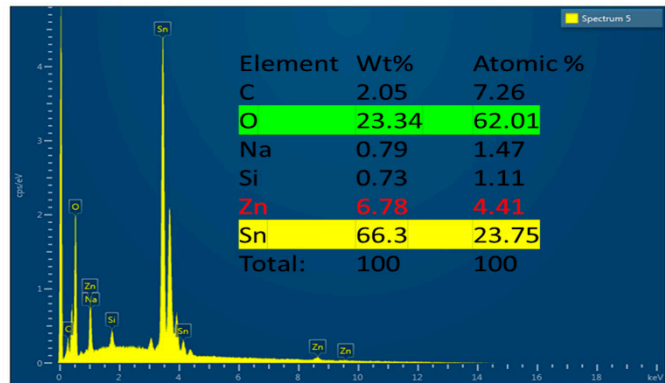
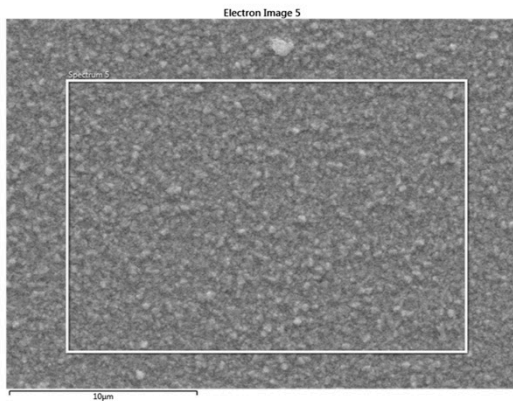


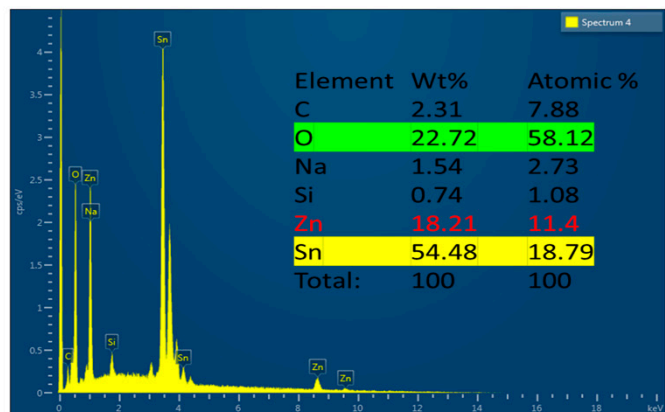
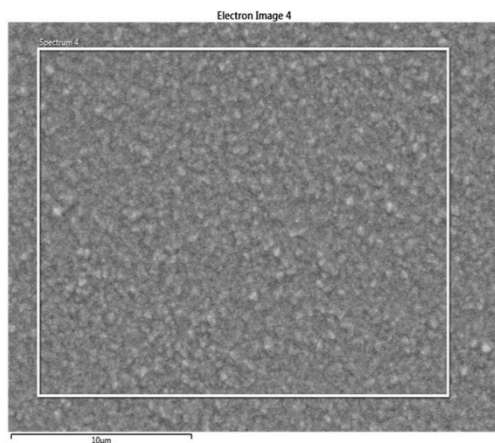
Figure S2. Setup used for measuring electrical response w.r.t RH%.

FESEM and EDS Analysis of Different Number of Spin-coated ZnO Thin Films

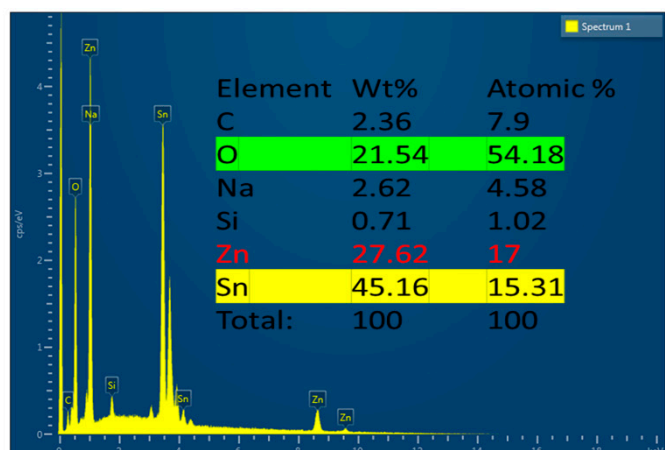
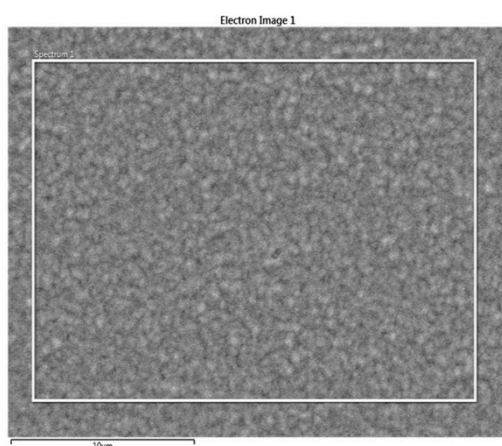
Figure S3, is showing an optimized analysis of ZnO thin film grown by sol-gel method, it is illustrating the effect of different number of spin-coatings on the morphological and elemental properties of ZnO thin films. The uniform ZnO thin films can be achieved by multiple number of spin-coatings, many authors reported different number of spin-coatings [1–3] to get uniform ZnO thin film. In this work, optimized study has been done, and we found that minimum seven times spin-coating is required to get a smooth ZnO thin film.



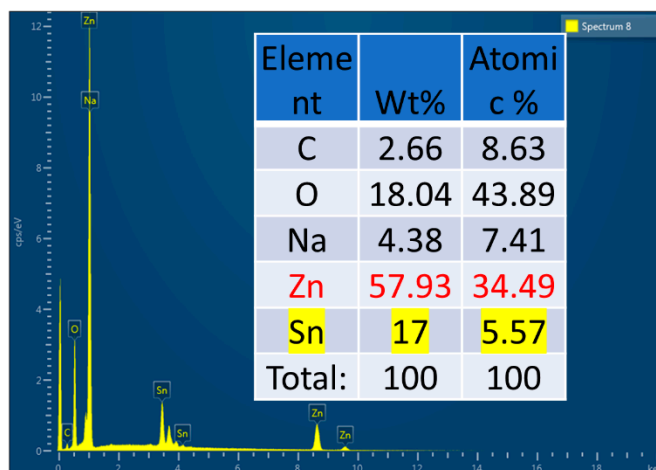
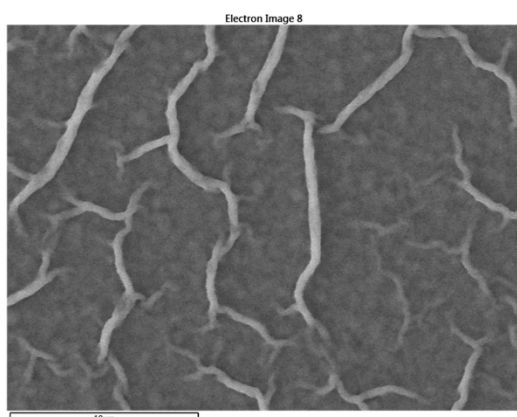
FESEM and EDS analysis of one time spin-coated ZnO thin film



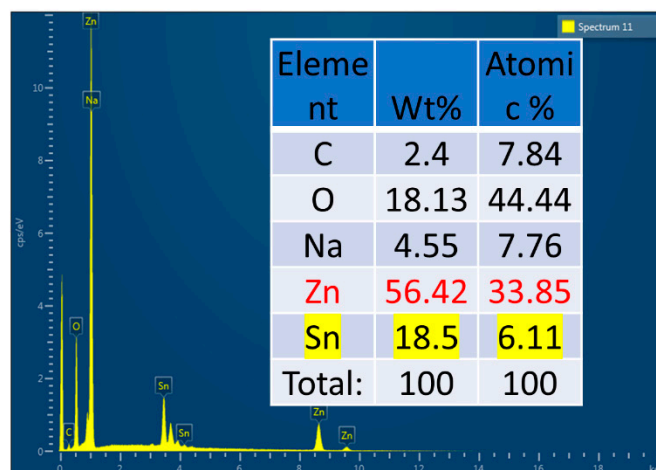
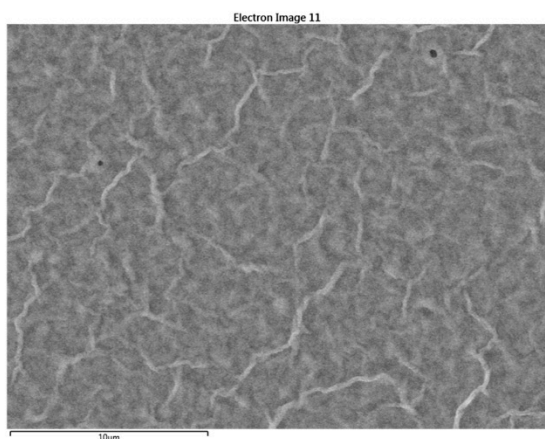
FESEM and EDS analysis of three time spin-coated ZnO thin film



FESEM and EDS analysis of five time spin-coated ZnO thin film



FESEM and EDS analysis of 7 times spin-coated ZnO thin film.



FESEM and EDS analysis of 9 times spin-coated ZnO thin film.

Figure S3. A detailed FESEM and EDS analysis of ZnO thin film.

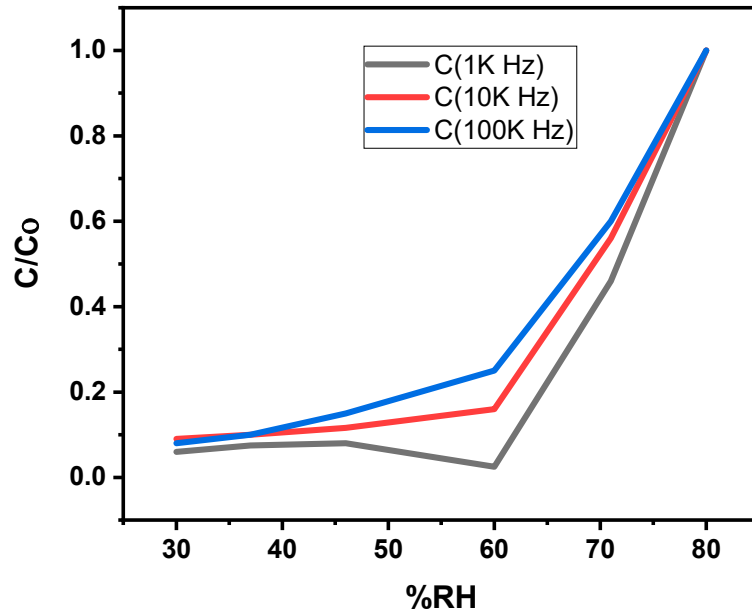


Figure S4. Normalized capacitance response of GrF/ZnO based humidity sensor at different frequencies.

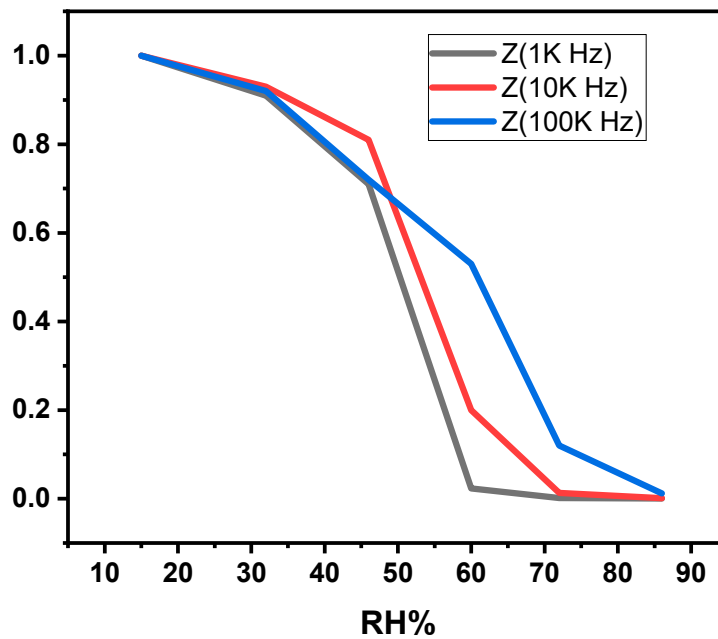


Figure S5. Normalized impedance response of GrF/ZnO based humidity sensor at different frequencies.

References

- [1] A. J. Hashim, M. S. Jaafar, A. J. Ghazai, and N. M. Ahmed, "Fabrication and characterization of ZnO thin film using sol-gel method," *Optik (Stuttg)*, vol. 124, no. 6, pp. 491–492, Mar. 2013, doi: 10.1016/j.ijleo.2011.12.059.
- [2] M. Z. Toe *et al.*, "Effect of ZnO seed layer on the growth of ZnO nanorods on silicon substrate," in

Materials Today: Proceedings, Jan. 2019, vol. 17, pp. 553–559, doi: 10.1016/j.matpr.2019.06.334.

- [3] T. Amakali, L. S. Daniel, V. Uahengo, N. Y. Dzade, and N. H. de Leeuw, "Structural and Optical Properties of ZnO Thin Films Prepared by Molecular Precursor and Sol–Gel Methods," *Crystals*, vol. 10, no. 2, p. 132, Feb. 2020, doi: 10.3390/cryst10020132.