Electronic Supplementary Material (ESI) for RSC Advances.

Supplementary Information

Porous silicon filled with Pd/WO_3-ZnO composite thin film for enhanced H_2 gas-sensing performance

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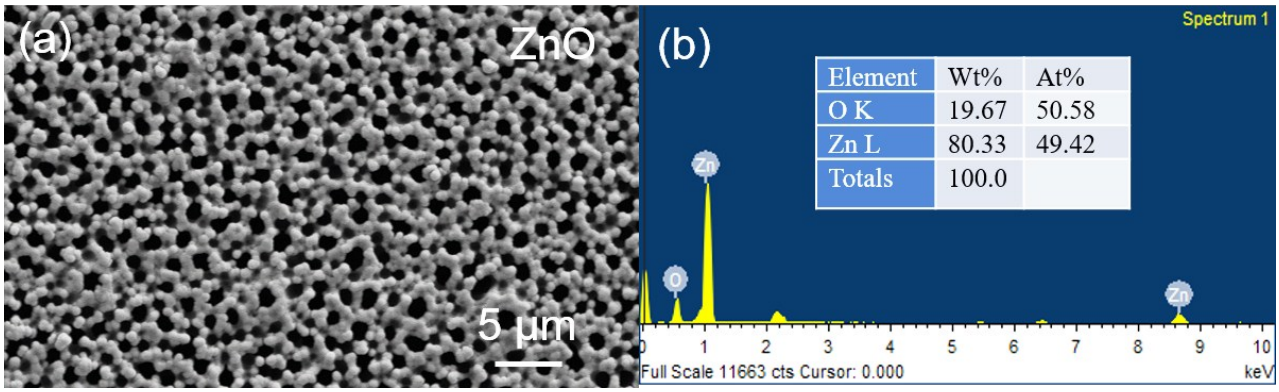
FIGURE S1



FigureS1: (a) The FE-SEM micrograph and (b) EDS spectra of bare ZnO sensing layer.

Figure S1 indicates that the silicon pores are uniformly filled with ZnO. The Zn and O elements are present in stoichiometric ratio.

FIGURE S2

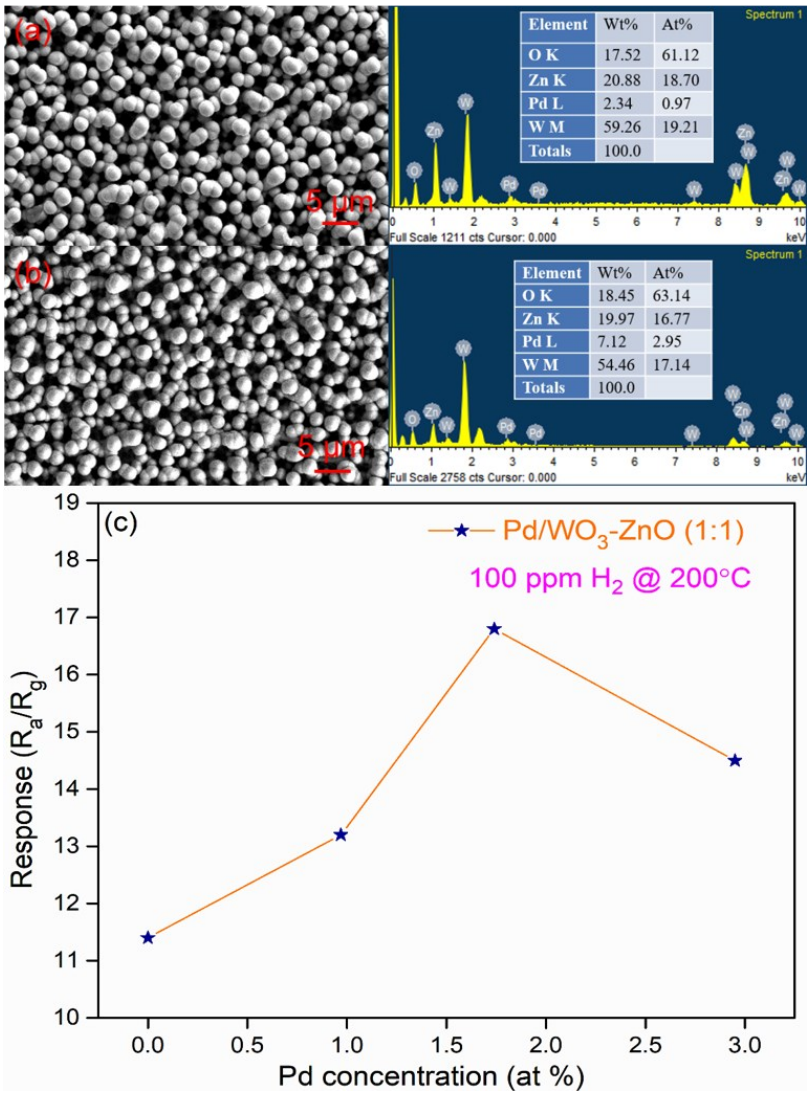


Figure S2: (a)-(b) FE-SEM images and corresponding EDS spectra of Pd decorated WO_3-ZnO thin films with varying Pd concentration and (c) The sensing response versus Pd concentration curves.

Figure S2 (c) Depicts that as Pd concentration rises the response to 100 ppm H_2 at 200°C increases up to 1.74 at %. Thereafter, response starts to decline as Pd concentration further increases to 2.95 at%.

FIGURE S3

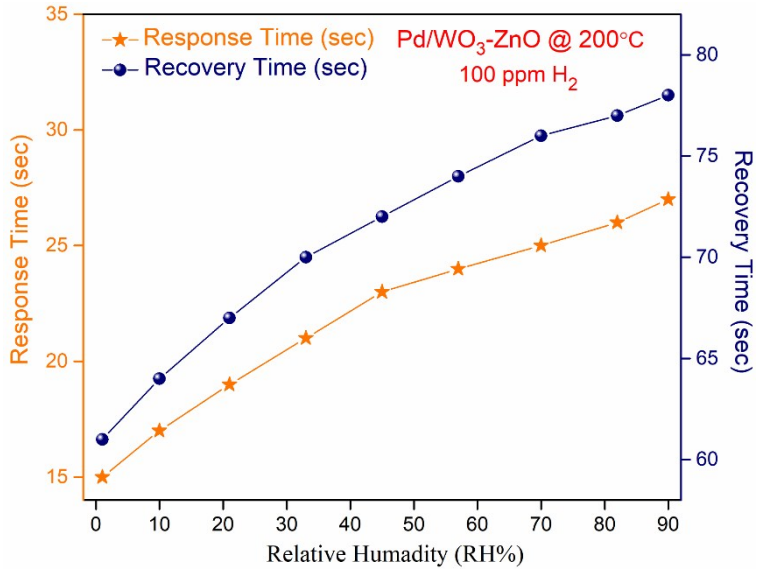


Figure S3: Response/recovery time variation versus humidity conditions (from 0-90% RH) for Pd/WO_3-ZnO composite layer towards100 ppm H_2 at 200°C.

Figure S3 shows that the at the same H_2 concentration response and recovery time continuously enhances with increasing up to 90 %RH.

FIGURE S4

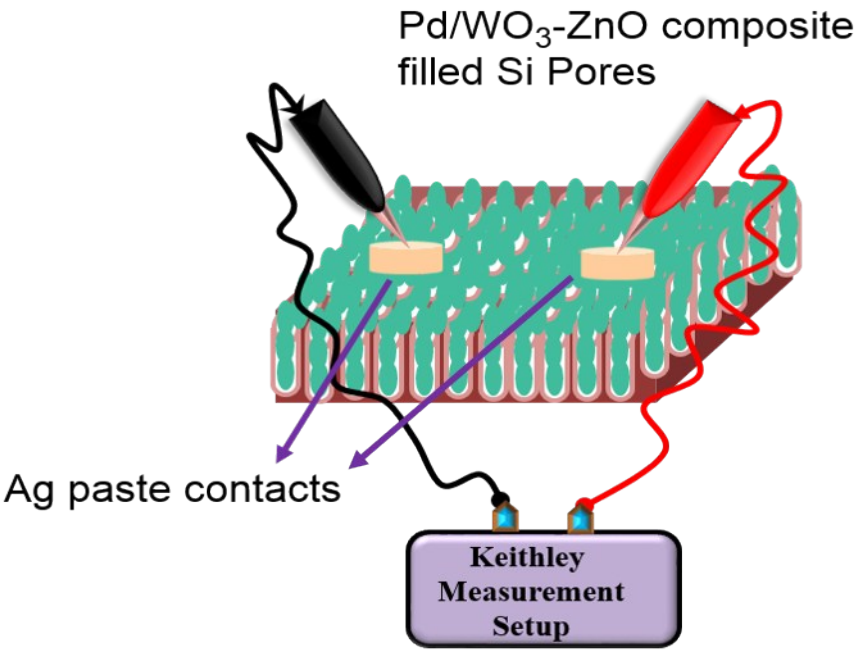


Figure S4. The schematic view of the Pd/WO_3-ZnO composite sensor on porous silicon with the silver (Ag) paste as top electrodes.

Table S1: Brief summary of previous reported literature on WO_3 and ZnO semiconductor oxide based hydrogen gas sensor.

Sensor (metal oxide)	Fabrication technique	H_2 ppm	Operating Temp.(°C)	Sensing response	Response/ recovery time	Ref.
Pd/WO_3/ZnO -Si	RF sputtering	10000	150	-	105 sec/25 sec	[1]
Pd/WO_3	Electro spinning and Sol-gel	500	300	30	20 sec/30 sec	[2]
Pd/ZnO-PSi	RF sputtering	2000	RT	4.82	408 s/420 s	[3]
Pd/WO_3-ZnO-PSi	DC sputtering	100	200	16.8	16 sec/62 sec	Present work

References

[1] Y. Liu, J. Yu, P. T. Lai, *International Journal of Hydrogen Energy,* 2014, **39**, 10313-10319.

[2] A. Nikfarjam, S. Fardindoost, A. Irajizad, *Polymers,* 2013, **5**, 45-55.

[3] S. Basu, A. Dutta, *Materials Chemistry and Physics*, 1997, **47**, 93-96.