Humidity Sensors Based on Graphene/SnO_x/CFs Nanocomposites

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Fig. S1

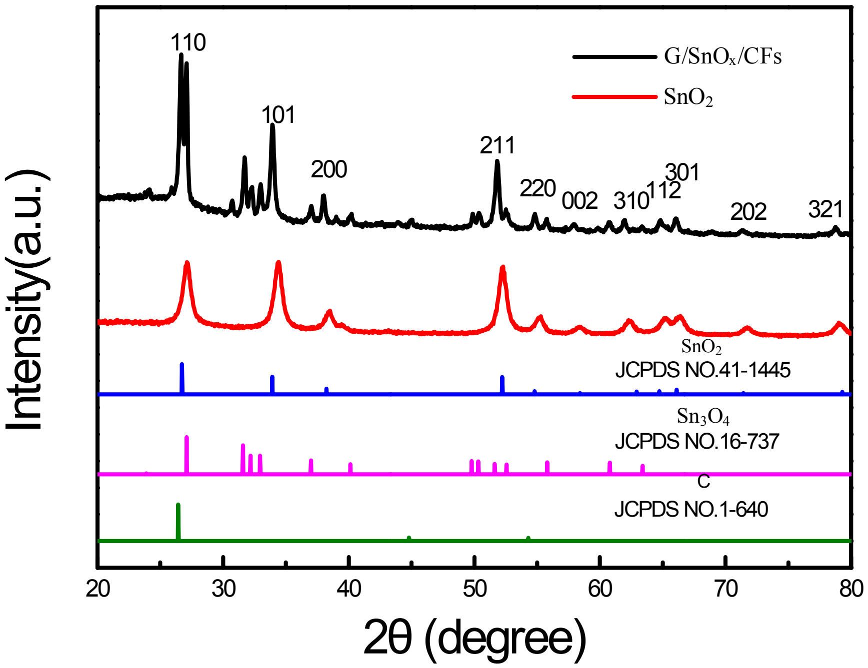

Fig. S1 XRD pattern of pure SnO_2 nanofibers and G/SnOx/CFs

Fig. S1 is the XRD pattern of pure SnO_2 nanofibers and G/SnO_x/CFs. All the peaks were similar to rutile phase SnO_2. Some additional weak peaks corresponding to Sn_3O_4 were also observed. Moreover, no peaks of carbon were found in XRD pattern which indicated that the carbon in SnO_x/CFs could be amorphous.

Fig. S2

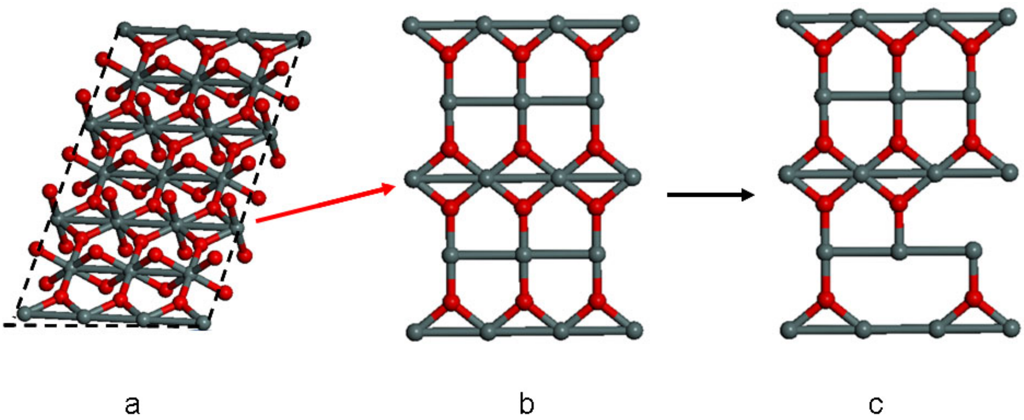

Fig. S2 Ball-and-stick model of SnO_2. (a) stereostructure of SnO_2, (b) an oxygen vacancy free plane of SnO_2, (c) a plane of SnO_2 with oxygen vacancy. Red atoms: O; Grey atoms: Sn.

It is well know that metal oxides can lose oxygen, resulting in the formation of oxygen vacancy. The crystal structure of SnO_2 and oxygen vacancies in SnO_2 can be seen from Fig. S2. Fig. S2b is a plane of the crystal structure which is helpful to understand the oxygen vacancy structure. From the ball-and-stick model and compared with Fig. S2b, two oxygen atoms were missed in Fig. S2c which formed two oxygen vacancies.

Fig. S3

Materials	measured parameter	Test Range (%RH)	Response Time (s)	Recovery Time (s)	Δ RH/Tres (%RH/s)	Δ RH/Trec (%RH/s)	Reference
single SnO_2 nanowire	current	5%-30%	120	20	0.208	1.250	J. AM. CHEM. SOC. 129, (2007), 6070-6071
single SnO_2 zigzag belt	resistance	5%-22.5%	30	80	0.583	0.219	Cryst. Res. Technol. 45, (2010), 539 – 544
SnO_2 nanoparticles	resistance	5%-95%	32	25	2.813	3.600	Materials Science and Engineering C 31 (2011) 840–844
G/SnO_x/CFs	resistance	30%-55%	8	6	3.125	4.167	this work

Actually, the response and recovery time are not comparable because of the difference in test range. To be more precisely, RH_s, the ratio of $\Delta RH/T_{res}$ or $\Delta RH/T_{rec}$ is determined. Where ΔRH is the difference of relative humidity, T_{res} is response time and T_{rec} is recovery time.

From the table above, the variation of relative humidity for one second in our work is higher than reported, which indicates that humidity sensor based on graphene/SnO_x/CFs has a fast response to the variation of humidity.