Highly-sensitive SnO_2 Nanofiber Chemiresistors with Low Optimal Operating Temperature: Synergistic Effect of Cu^{2+}/Au Co-doping

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Electronic Supplementary Information

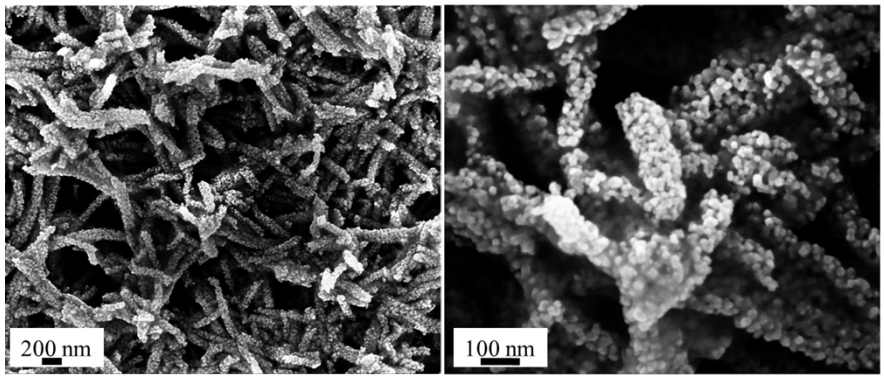
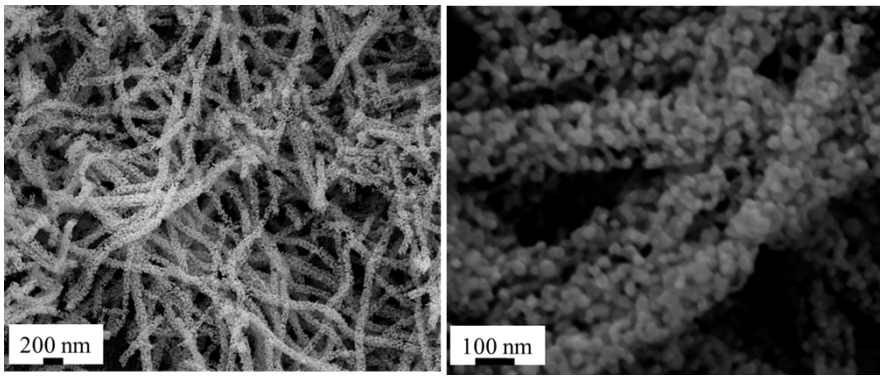
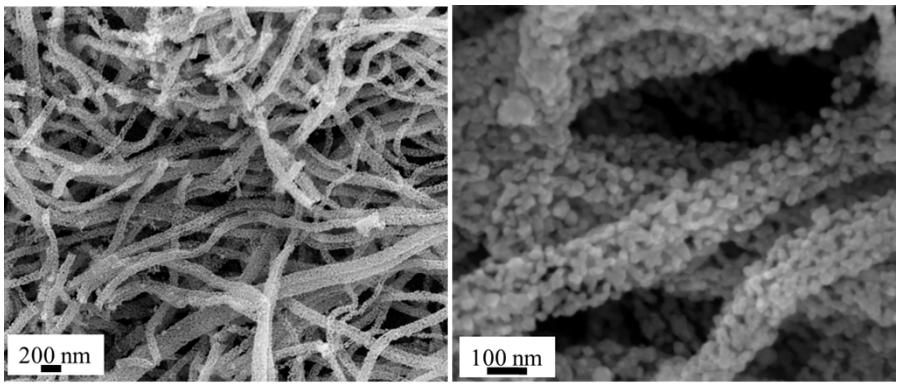


Fig. S1 SEM images of pure SnO_2 nanofibers with low and high magnifications.

CASNFs (1Cu/5Au/SnO_2)



CASNFs (2Cu/5Au/SnO_2)



CASNFs (3Cu/5Au/SnO_2)

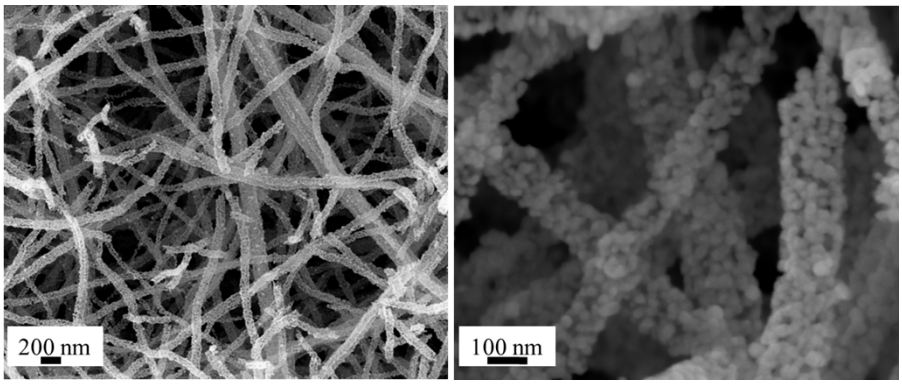


Fig. S2 SEM images of CASNFs with different Cu/Au/Sn ratios (3Cu/5Au/SnO_2 is referred to as Cu/Au/Sn ratio = 3:5:100 atom/atom in the nanofibers).

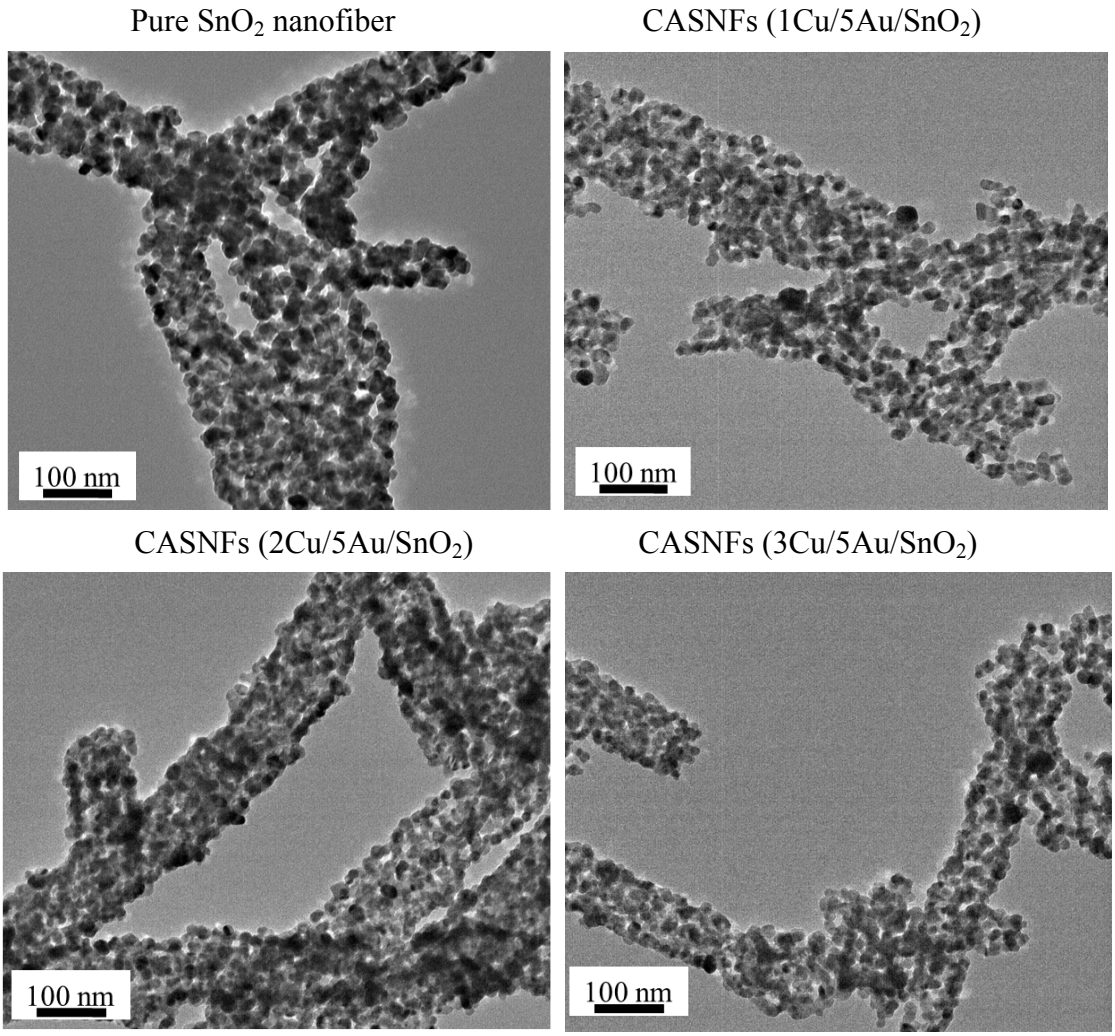


Fig. S3 TEM images of pure SnO_2 nanofiber and CASNFs with different Cu/Sn ratios (the Au/Sn ratio in all the sample was fixed at 5:100 atom/atom).

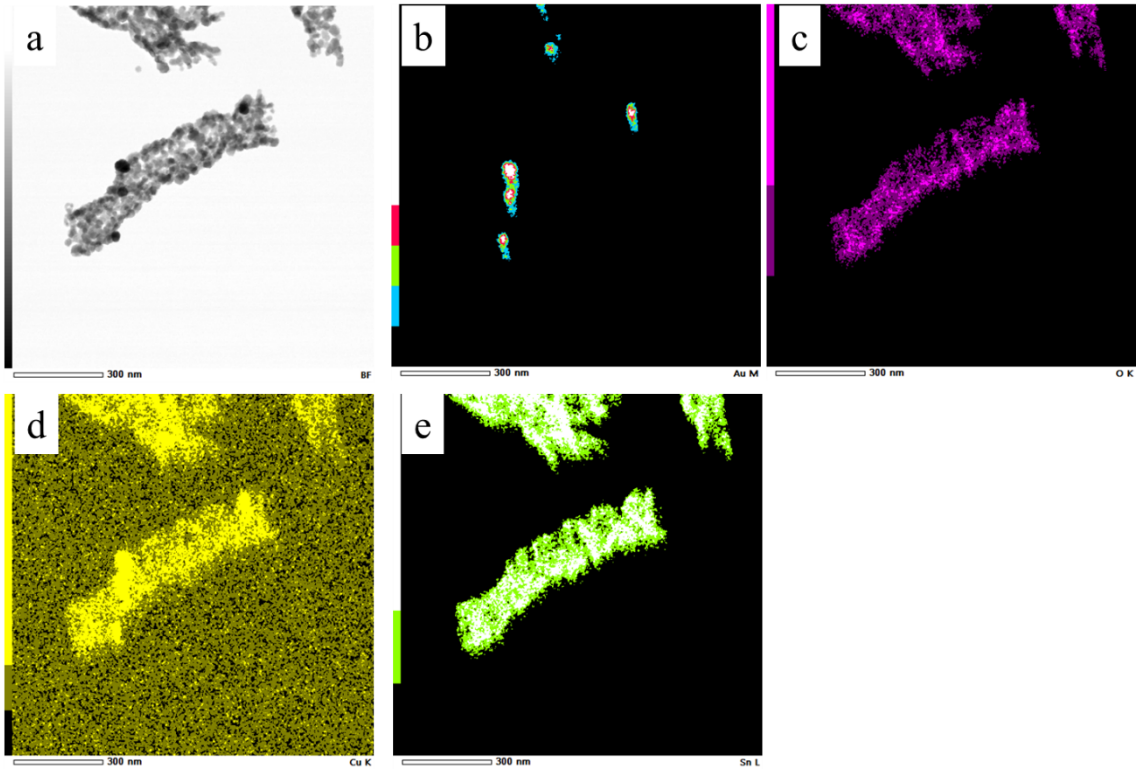


Fig. S4 (a) TEM image of Cu^{2+}/Au co-doped SnO_2 nanofiber (1Cu/5Au/SnO_2), and (b)~(e) TEM EDS maps of the same area. The abundant navy/red, purple, yellow, and grass green dots indicate the locations of (b) Au, (c) O, (d) Cu, and (e) Sn, respectively. (Cu is found to distribute out of the nanofibers, due to the use of a Cu TEM grid.)

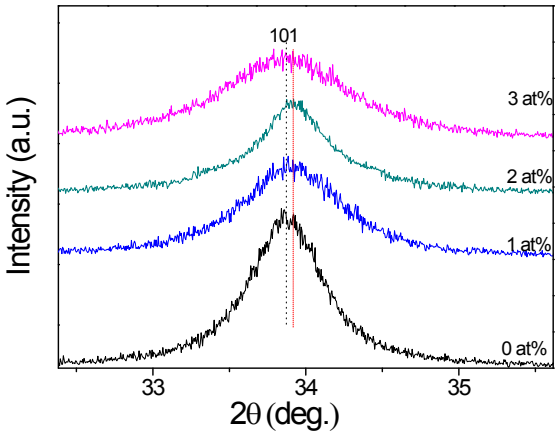


Fig. S5 High-resolution XRD to show the (101) peak of Cu-doped SnO_2 nanofibers (step length: 0.005/step).

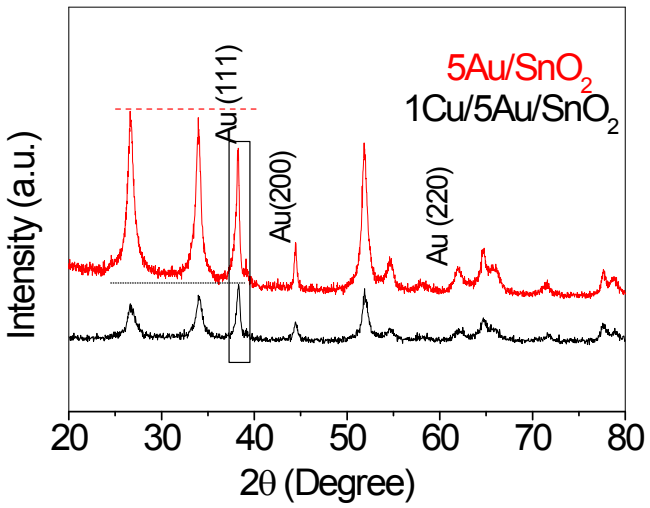


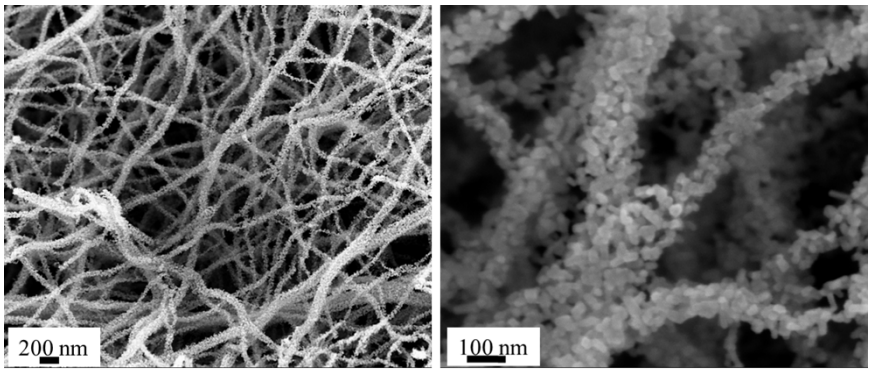
Fig. S6 XRD patterns of Cu^{2+}-doped and Cu^{2+}/Au co-doped SnO_2 nanofibers.

Table S1 Comparison between different MOCs against C_2H_2*

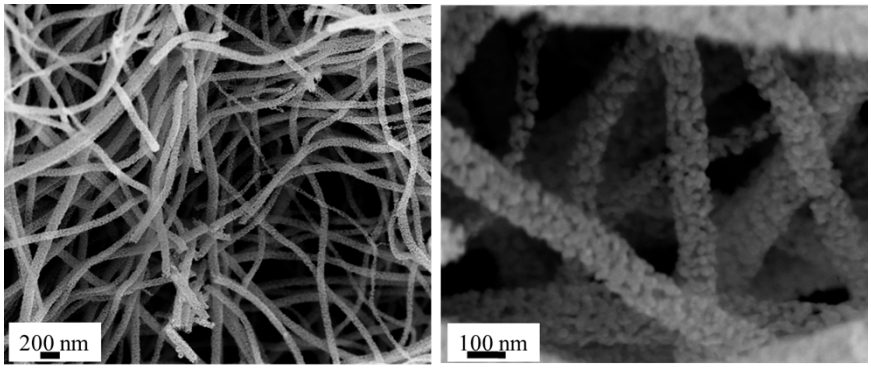
MOCs	*C_2H_2 (ppm)*	*Operating Temperature (°C)*	*R_a/R_g*	*t_1/t_2* (s/s)	*Ref*
Our experiment (1Cu/5Au/SnO_2)	100	160	~10.8	5/13	
Pd-doped SnO_2	100	350	~3.6	6/11	S1
Ni-doped ZnO	100	250	~2.7	7/10	S2
Pt/ZnO	1,000	300	~45	6/65	S3
Sm_2O_3-doped SnO_2	100	180	~8.3	8/14	S4
$ZnFe_2O_4$	1000	350	~12		S5
$CuFe_2O_4$	1000	250	~15	-	S5
$CdFe_2O_4$	1000	250	~31		S5
$MgFe_2O_4$	1000	250	~22		S5
Flame-spray-made SnO_2 nanoparticles	10,000	300	~6.3	34/14	S6
Nanoparticle-decorated ZnO microdisk	200	420	~52	15/19	S7
γ-Fe_2O_3 powder	1,000	380	~15	35/41	S8

*To give convictive comparative data, we have made a suitable transformation to these data by defining S=Ra/Rg.

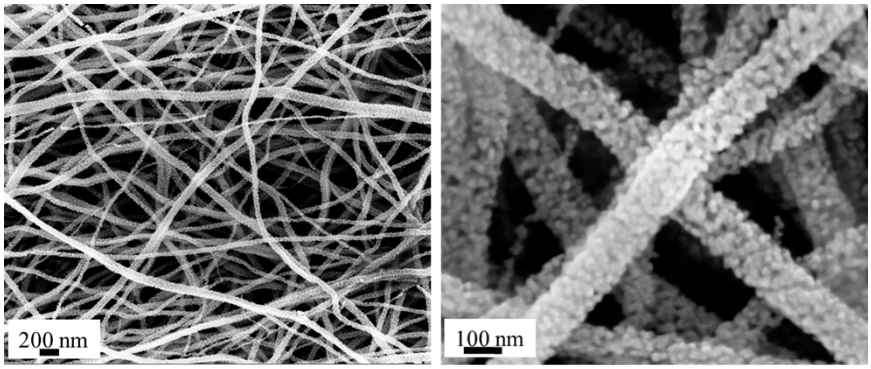
1Cu/SnO_2 nanofibers



2Cu/SnO_2 nanofibers



3Cu/SnO_2 nanofibers



5Au/SnO_2 nanofibers

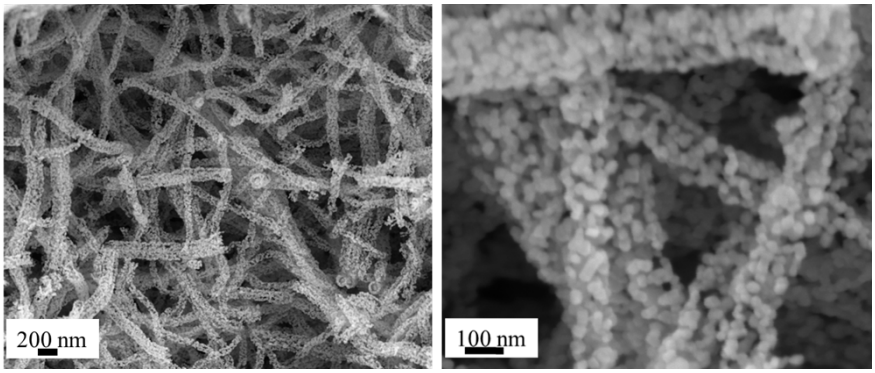
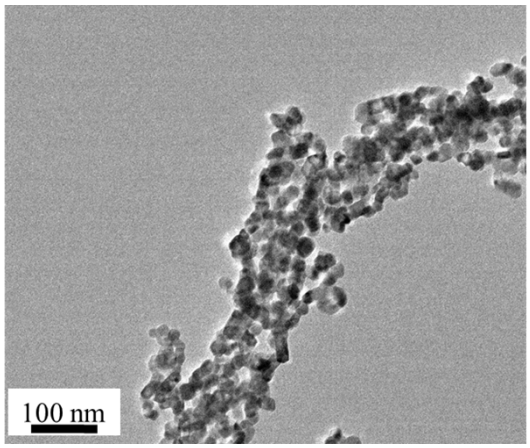
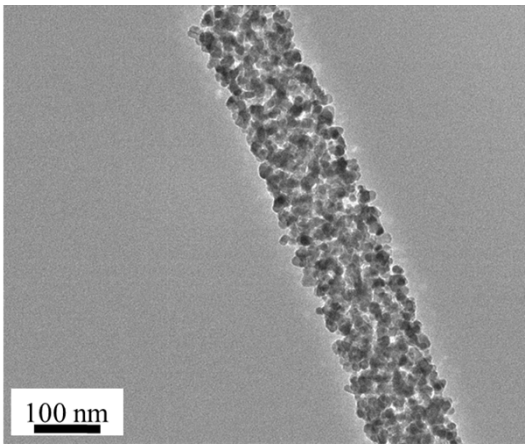


Fig. S7 SEM images of Cu^{2+}- or Au-doped SnO_2 nanofibers.

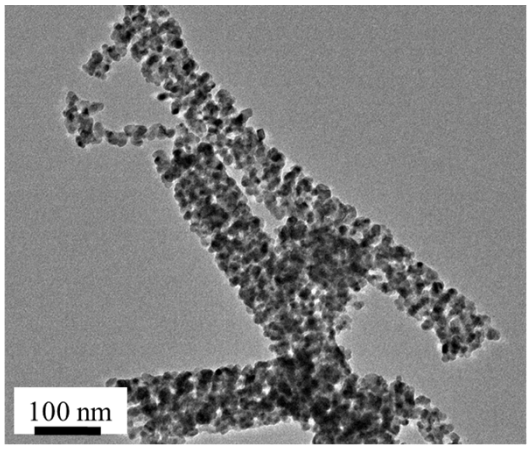
SnO_2 nanofibers 1at% Cu doped



SnO_2 nanofibers 2at% Cu doped



SnO_2 nanofibers 3at% Cu doped



SnO_2 nanofibers 5at% Au doped

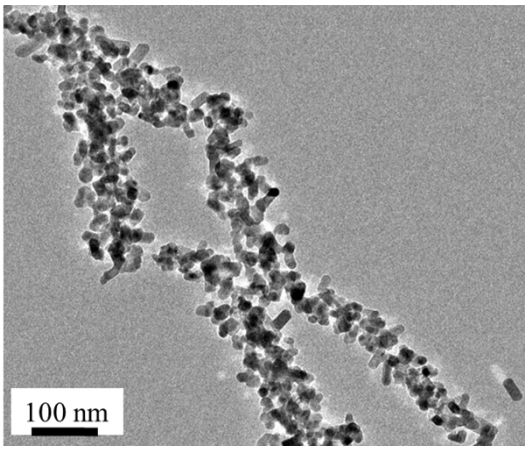


Fig. S8 TEM images of Cu^{2+}- or Au-doped SnO_2 nanofibers.

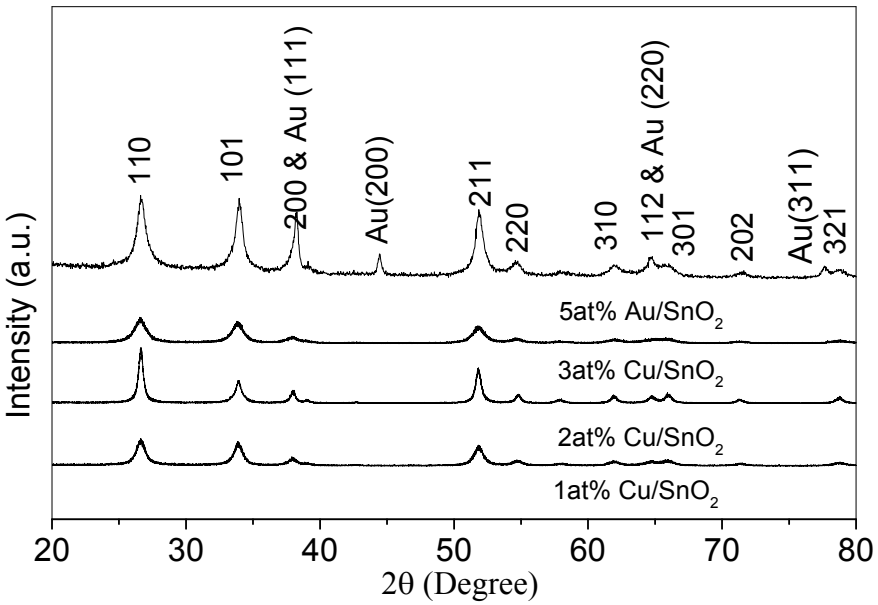
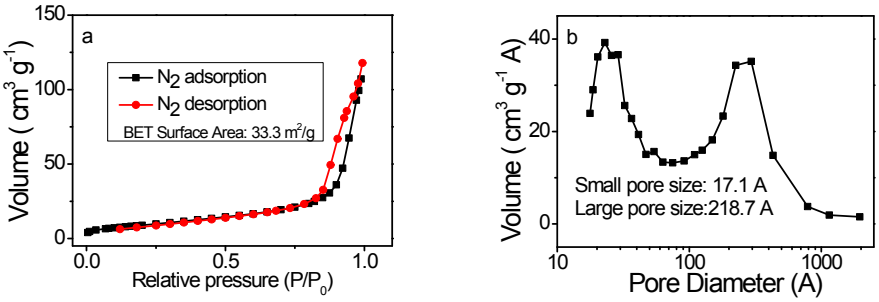
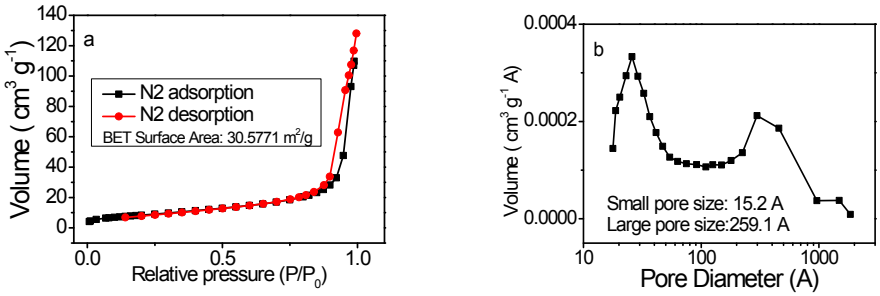


Fig. S9 XRD results of Cu^{2+}- or Au-doped SnO_2 nanofibers.

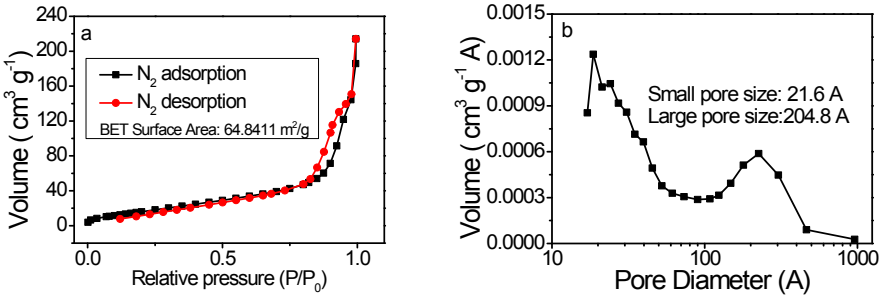
Pure SnO_2 nanofibers



5Au/SnO_2 nanofibers



2Cu/SnO_2 nanofibers



1Cu/5Au/SnO_2 nanofibers

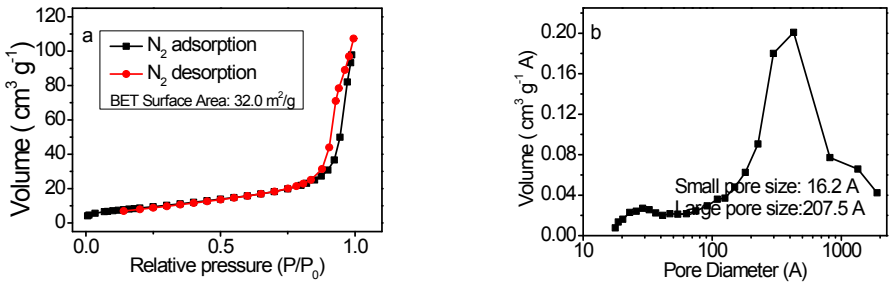


Fig. S10 Nitrogen adsorption – desorption isotherms and pore size distribution of nanofiber samples.

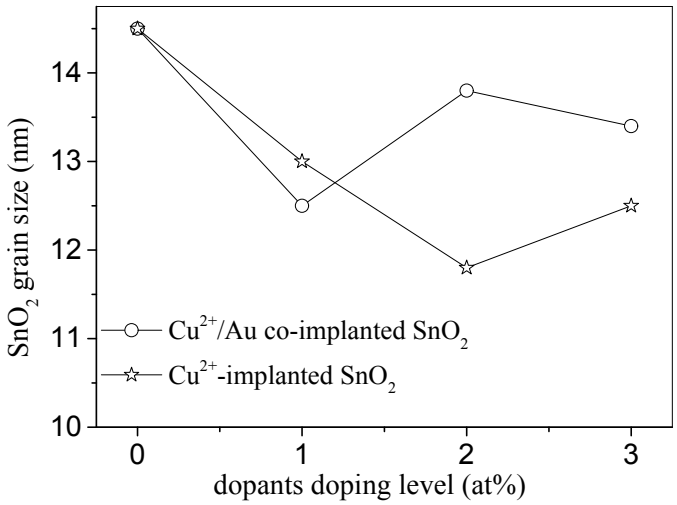


Fig. S11 Effect of Cu^{2+}-doping and Cu^{2+}/Au co-doping on the SnO_2 grain size of nanofibers (calculated by $D = K\lambda/\beta \cos\theta$).

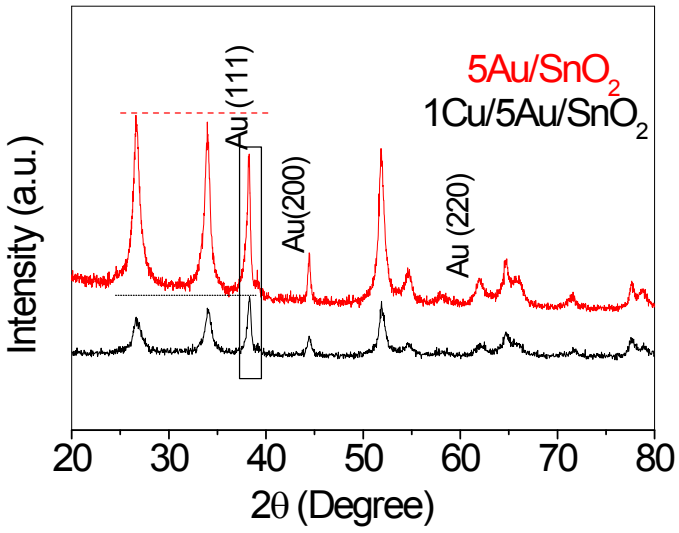


Fig. S12 Effect of Cu^{2+}-doping on Au (111) phase.

References

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