Improved sensitivity of UV sensors in hierarchically structured arrays of network-loaded ZnO nanorods via optimization techniques

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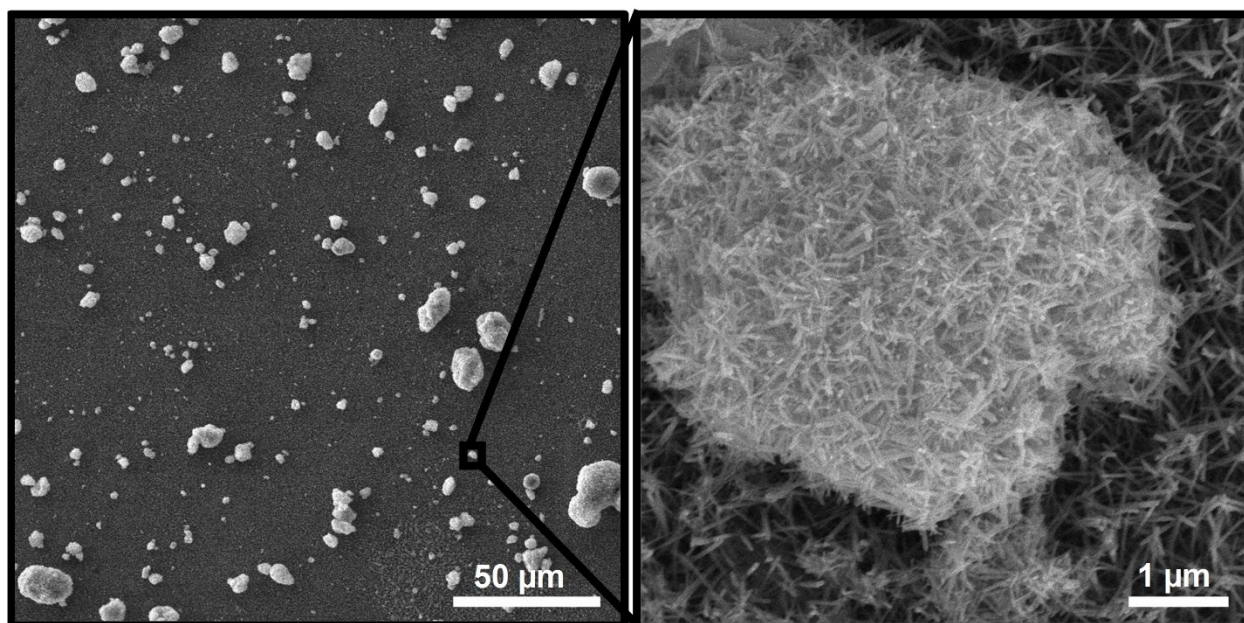
Fig.S1. SEM image secondary ZnO NRs dispersed on the firstly grown vertical ZnO NRs without the use of homogenizing pulse mode of ultrasonication for the preparation of ZnO colloidal solution. Unwanted highly agglomerated microparticels of ZnO NRs are shown in zoom-up image (right panel).
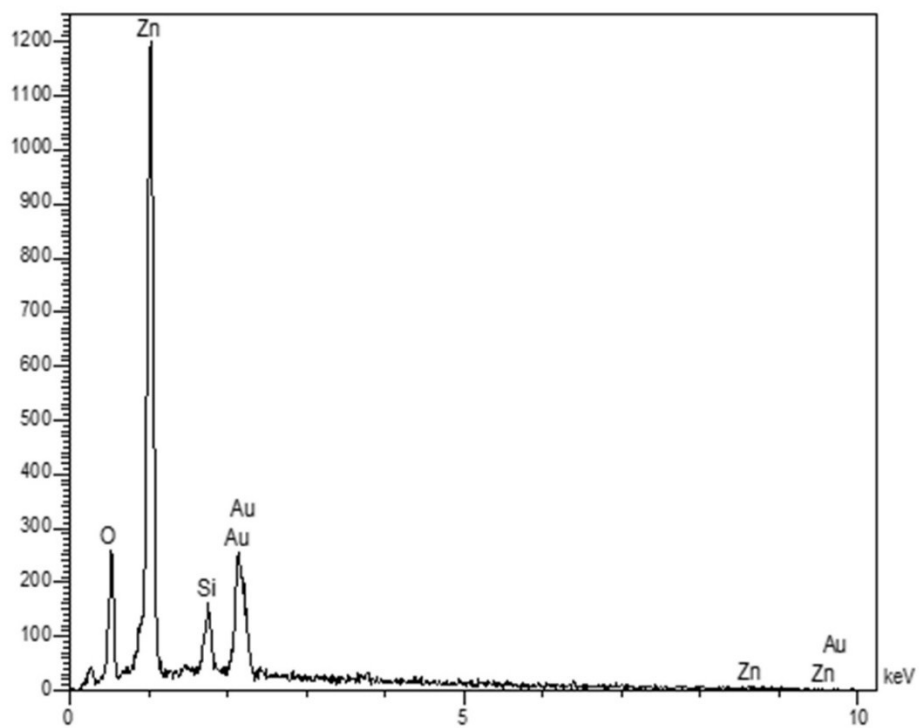
Fig. S2. EDS analysis of ZnO NRs. Different peaks related to oxygen, zinc, silicon, and gold atoms. Si and Au are the main elements of glass substrate and conductive layer, respectively.
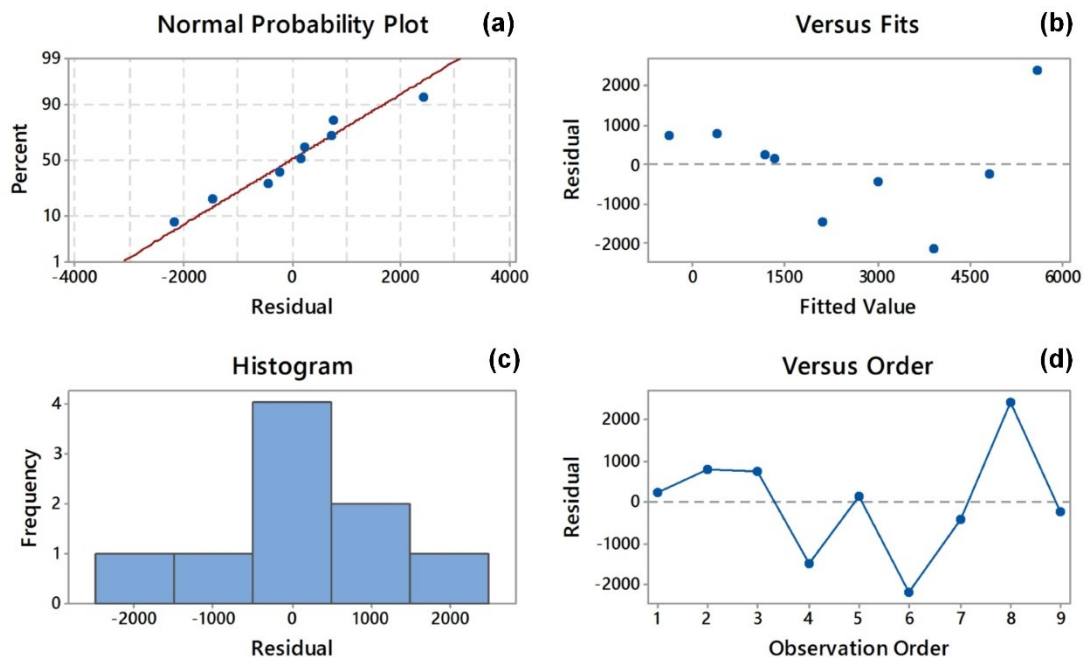
Fig. S3. Residual plots of the modelling used to optimize the sensitivity and responsivity of the UV sensor based on network-loaded ZnO NRs (a) normal probability plot, (b) residual versus fits, (c) residual histogram, and (d) residual versus observation order.

Table S1. ANOVA results acquired from regression analysis of taguchi experimental measurments.

Source	DF	Adj. SS	Adj. MS	F-Value	P-Value
Regression	3	32974399	10991466	2.41	0.03
Concentration (mg ml^{-1})	1	24746968	24746968	7.32	0.047
Deposition cycles (No.)	1	717996	717996	0.25	0.039
Deposition time (s)	1	7509435	7509435	2.03	0.042
Error	5	14213581	2842716		
Total	8	47187980			

Table S2: Coded experiments, operating parameters, levels of experiments, and optimization factor for different experiments based on Taguchi method.

| Code of Sample	Concentration (mg ml^{-1})	Deposition Cycle (Number)	Deposition Time (s)	Optimization factor of Sensitivity & Responsivity (a.u.)	Selected for further analyses
$C_{0.5}DC_1DT_{60}$	0.5	1	60	6866.2	No
$C_{0.5}DC_3DT_{180}$	0.5	3	180	606.5	No
$C_{0.5}DC_5DT_{300}$	0.5	5	300	1611.1	No
$C_{1.0}DC_1DT_{180}$	1.0	1	180	518.3	No
$C_{1.0}DC_3DT_{300}$	1.0	3	300	9511.2	No
$C_{1.0}DC_5DT_{60}$	1.0	5	60	6516.0	Yes (denoted as *low performance*)
$C_{1.5}DC_1DT_{300}$	1.5	1	300	3307.9	No
$C_{1.5}DC_3DT_{60}$	1.5	3	60	22401.1	Yes (denoted as *optimized performance*)
$C_{1.5}DC_5DT_{180}$	1.5	5	180	12859.5	Yes (denoted as *med performance*)
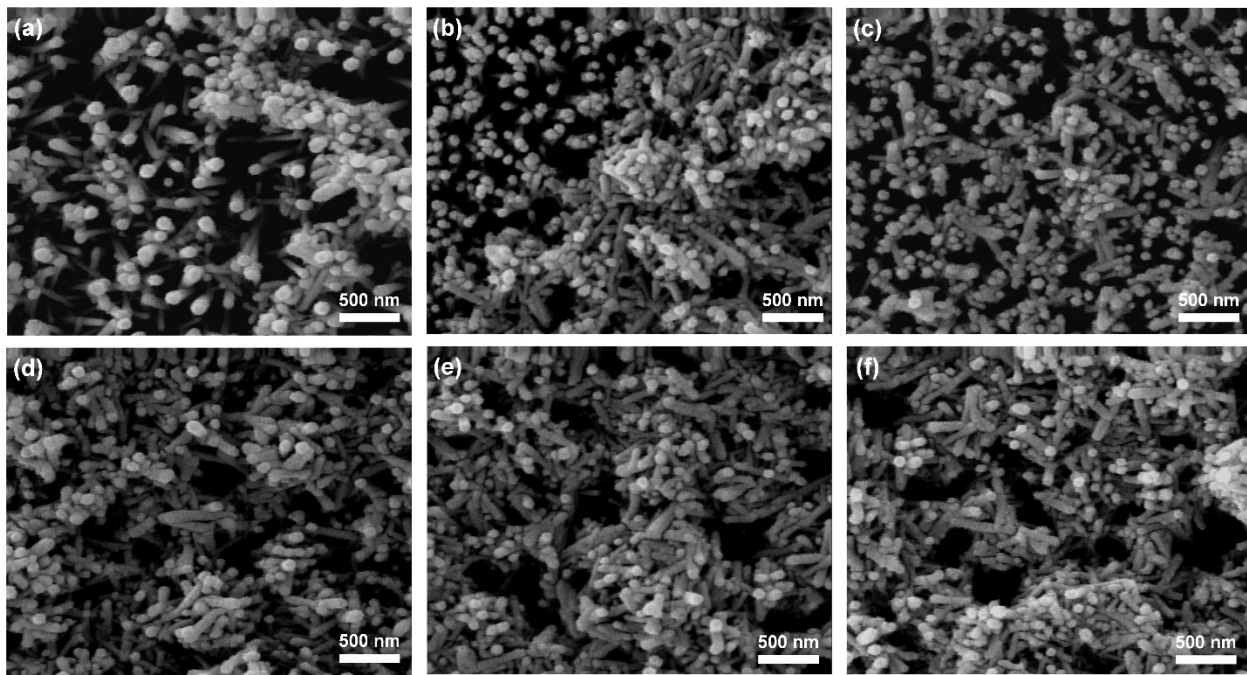
Fig. S4. Top-view SEM images of ZnO networks deposited over the first grown ZnO NRs showing (a) $C_{0.5}DC_1DT_{60}$, (b) $C_{0.5}DC_3DT_{180}$, (c) $C_{1.0}DC_1DT_{180}$, (d) $C_{0.5}DC_5DT_{300}$, (e) $C_{1.0}DC_3DT_{300}$, and (f) $C_{1.5}DC_1DT_{300}$ samples.