

Supporting information

Self-Adaptive Gas Sensor System based on Operating Conditions using Data Prediction

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Table S1. Various types of SnO₂-based acetone gas sensors with their responses for specific concentrations.

Sensing material	Response	Concentration	Reference
SnO ₂ microsphere with Au and NiO	5.0	1000 ppb	[31]
Ru-doped SnO ₂ nanofibers	8.9	5000 ppb	[32]
Mesoporous SnO ₂	1.5	1000 ppb	[33]
Co-catalyzed SnO ₂ nanosphere	1.8	1000 ppb	[34]
SnO ₂ nanowire with Co ₃ O ₄ nanoparticles	4.0	1000 ppb	[35]
Nanotubular SnO ₂	1.6	1000 ppb	[36]
Pt-doped 3D porous SnO ₂	2.1	50 ppb	[37]
Fe ₂ O ₃ /SnO ₂ Nanoball	4.0	50 ppb	[38]
SnO ₂ nanosheet	5.8 15.4	50 ppb 1000 ppb	Present work

Table S2. Analysis of variance (ANOVA) of the terms for the 2^3 factorial design with center points.

(a) without curvature

Source	Sum of squares	df ^a	Mean squares	F-value	p-value
Model	171.06	6	28.51	0.85	0.5801
A-Temperature	1.92	1	1.92	0.06	0.8199
B-Gas flow	3.89	1	3.89	0.12	0.7466
C-Concentration	161.64	1	161.64	4.85	0.0790
AB	0.17	1	0.17	0.01	0.9461
AC	0.31	1	0.31	0.01	0.9267
BC	3.13	1	3.13	0.09	0.7719
Residual	166.81	5	33.36	-	-
Lack of Fit	160.69	2	80.35	39.42	0.0070
Pure Error	6.11	3	2.04	-	-
Cor Total	337.86	11		-	-
Std. Dev. ^b	5.78		R ²	0.5063	
Mean	10.86		Adjusted R ²	-0.0862	
C.V. % ^c	53.20		Predicted R ²	-6.0456	
BIC ^d	83.03		Adeq Precision ^e	2.5763	

^aDegree of freedom

^bStandard of deviation

^cCoefficient of variation

^dBayesian information criterion

^eAdequate precision

(b) with curvature

Source	Sum of squares	df ^a	Mean squares	F-value	p-value
Model	171.06	6	28.51	5.76	0.0559
A-Temperature	1.92	1	1.92	0.39	0.5670
B-Gas flow	3.89	1	3.89	0.79	0.4252
C-Concentration	161.64	1	161.64	32.67	0.0046
AB	0.17	1	0.17	0.03	0.8627
AC	0.31	1	0.31	0.06	0.8141
BC	3.13	1	3.13	0.63	0.4713
Curvature	147.02	1	147.02	29.71	0.0055
Residual	19.79	4	4.95	-	-
Lack of Fit	13.68	1	13.68	6.71	0.0810
Pure Error	6.11	3	2.04	-	-
Cor Total	337.86	11			
Std. Dev. ^b	2.22		R ²	0.8963	
Mean	10.86		Adjusted R ²	0.7408	
C.V. % ^c	20.49		Predicted R ²	-3.6433	
BIC ^d	57.45		Adeq Precision ^e	7.0616	

^aDegree of freedom

^bStandard of deviation

^cCoefficient of variation

^dBayesian information criterion

^eAdequate precision

Table S3. Analysis of variance (ANOVA) of the terms for full model by FCCCM-RSM.

Source	Sum of squares	df ^a	Mean squares	F-value	p-value
Block	45.72	1	45.72	-	-
Model	426.01	9	47.33	13.27	0.0003
A-Temperature	0.45	1	0.45	0.12	0.7320
B-Gas flow	11.09	1	11.09	3.11	0.1117
C-Concentration	228.10	1	228.10	63.94	<0.0001
AB	0.17	1	0.17	0.05	0.8329
AC	0.31	1	0.31	0.09	0.7741
BC	3.13	1	3.13	0.88	0.3737
A ²	85.28	1	85.28	23.91	0.0009
B ²	0.11	1	0.11	0.03	0.8617
C ²	5.58	1	5.58	1.56	0.2426
Residual	32.11	9	3.57	-	-
Lack of Fit	25.89	5	5.18	3.33	0.1334
Pure Error	6.22	4	1.55	-	-
Cor Total	503.84	19	-	-	-
Std. Dev. ^b	1.89		R ²	0.9299	
Mean	12.09		Adjusted R ²	0.8598	
C.V. % ^c	15.62		Predicted R ²	0.0197	
BIC ^d	99.18		Adeq Precision ^e	11.7276	

^aDegree of freedom

^bStandard of deviation

^cCoefficient of variation

^dBayesian information criterion

^eAdequate precision

Table S4. Analysis of variance (ANOVA) of the terms for reduced models by stepwise regression via (a) p-value and (b) BIC criteria.

(a) RM-1

Source	Sum of squares	df ^a	Mean squares	F-value	p-value
Block	45.72	1	45.72	-	-
Model	404.25	3	134.75	37.52	<0.0001
A-Temperature	0.45	1	0.45	0.12	0.7297
C-Concentration	228.10	1	228.10	63.52	<0.0001
A ²	175.71	1	175.71	48.93	<0.0001
Residual	53.87	15	3.59	-	-
Lack of Fit	47.65	11	4.33	2.79	0.1671
Pure Error	6.22	4	1.55	-	-
Cor Total	503.84	19	-	-	-
Std. Dev. ^b	1.90		R ²	0.8824	
Mean	12.09		Adjusted R ²	0.8589	
C.V. % ^c	15.67		Predicted R ²	0.7830	
BIC ^d	91.55		Adeq Precision ^e	17.5586	

^aDegree of freedom

^bStandard of deviation

^cCoefficient of variation

^dBayesian information criterion

^eAdequate precision

(b) RM-2

Source	Sum of squares	df ^a	Mean squares	F-value	p-value
Block	45.72	1	45.72		
Model	422.29	5	84.46	30.65	<0.0001
A-Temperature	0.45	1	0.45	0.16	0.6943
B-Gas flow	11.09	1	11.09	4.02	0.0661
C-Concentration	228.10	1	228.10	82.77	<0.0001
A ²	99.03	1	99.03	35.93	<0.0001
C ²	6.95	1	6.95	2.52	0.1362
Residual	35.83	13	2.76	-	-
Lack of Fit	29.61	9	3.29	2.12	0.2445
Pure Error	6.22	4	1.55	-	-
Cor Total	503.84	19		-	-
Std. Dev. ^b	1.66		R ²	0.9218	
Mean	12.09		Adjusted R ²	0.8917	
C.V. % ^c	13.73		Predicted R ²	0.7882	
BIC ^d	89.39		Adeq Precision ^e	16.9034	

^aDegree of freedom^bStandard of deviation^cCoefficient of variation^dBayesian information criterion^eAdequate precision

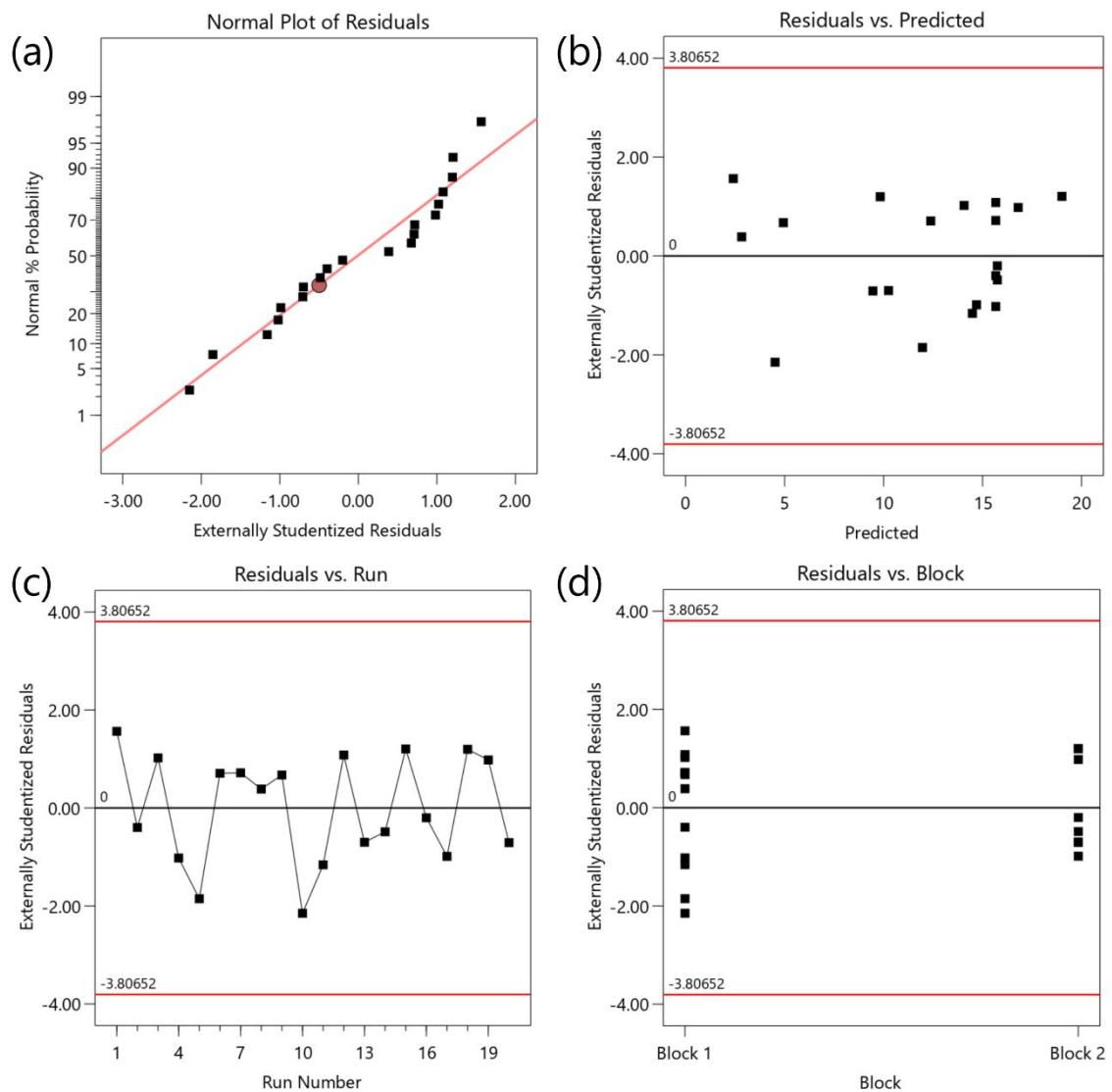


Fig. S1. Diagnostic plots for RM-2 model including (a) normal plot of residuals, (b) residuals versus predicted plot, (c) residuals versus run plot and (d) plot of residuals versus blocks.