Supplementary Information

Precisely Tailored $LaFeO_3$ Dendrites using Urea and Piperazine Hexahydrate for Highly Sensitive, Selective and Trace Level Detection of Acetone

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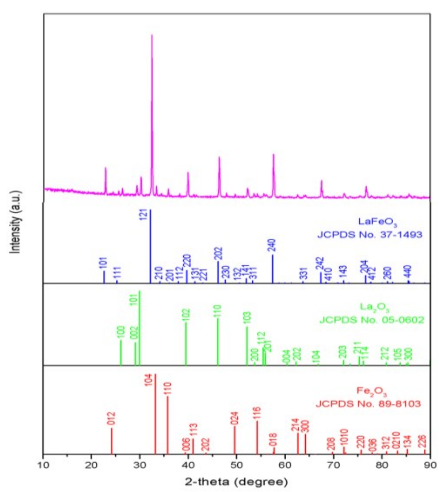
Table S1. Detailed reactant concentrations and corresponding outcomes

S. No	Sample code	Piperazine hexahydrate mM [mg]	Urea mM [mg]	Before/ After pH	Crystalline Phase	Morphology
1	U9	0	9 (540.54)	2.67/9.30	$LaFeO_3$	Irregular Particle with Aggregation
2	U9P3	3 (582.69)	9 (540.54)	6.74/9.35	$La(OH)_3$, $LaFeO_3$	Parallelogram and Irregular Structures
3	U9P6	6 (1165.38)	9 (540.54)	9.49/9.56	$LaFeO_3$	Dendritic Growth Initiation
4	U9P9	9 (1748.07)	9 (540.54)	9.54/9.60	$LaFeO_3$	Early - Stage Dendrites
5	U9P12	12 (2330.76)	9 (540.54)	9.88/9.92	$LaFeO_3$	Mid - Stage Dendrites
6*	U9P15	15 (2913.45)	9 (540.54)	9.90/9.90	$LaFeO_3$	Fully Grown Dendrites
7	U9P18	18 (3496.14)	9 (540.54)	10.01/10.03	$LaFeO_3$	Fully Grown Dendrites
8	U9P21	21 (4078.83)	9 (540.54)	10.10/10.12	$LaFeO_3$	Fully Grown Dendrites
9	P15	15 (2913.45)	0	9.88/9.90	La_2O_3, Fe_2O_3, $LaFeO_3$	Matured Dendrites

Note : (1) Stoichiometric ratio of 1 mM $La(NO_3)_3 \cdot xH_2O$ and 1 mM $Fe(NO_3)_3 \cdot 9H_2O$ were used for all reactions.
(2) The reaction temperature was kept at 180 °C for 24 h.
(3) The final products were dried at 110 °C for 1 h and calcinated at 900 °C for 3 h.
(4) * represents the optimized final reactant concentration.

a



b

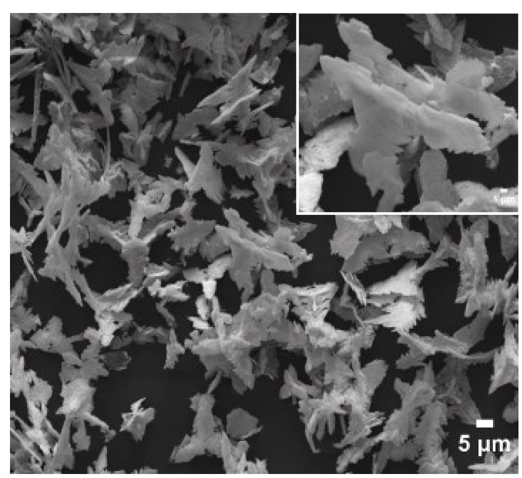


Fig. S1 a) XRD pattern and b) SEM images of 15 mM piperazine hexahydrate (P15) assisted $LaFeO_3$ dendrites formation process.

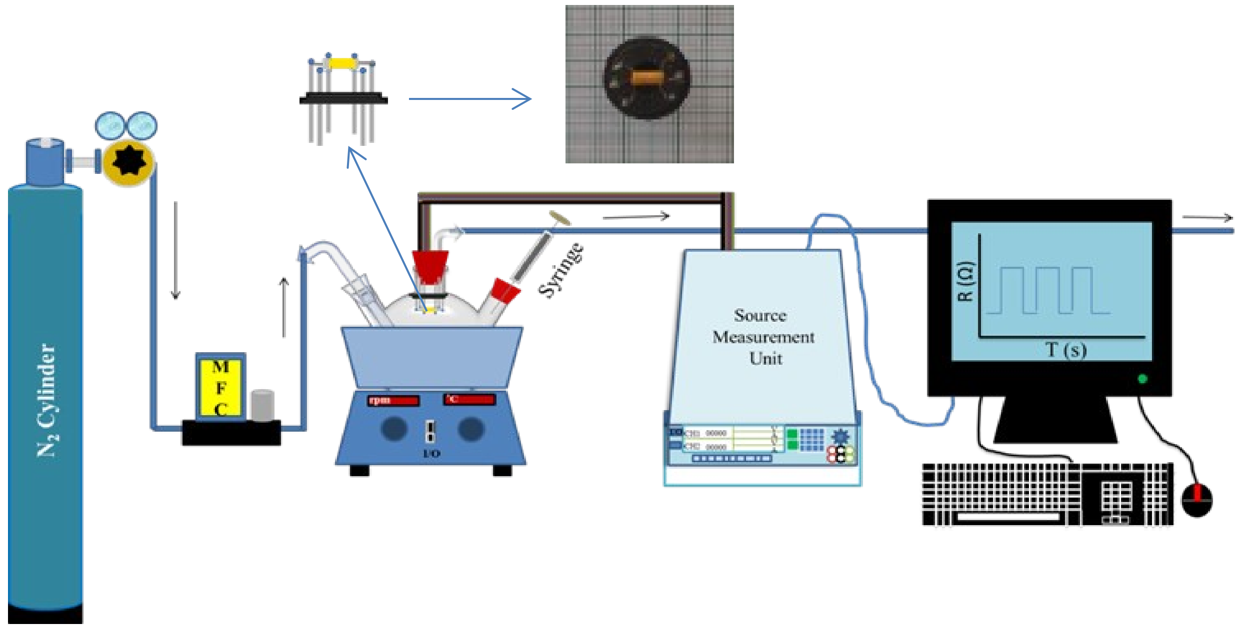


Fig. S2 Schematic illustration of custom made vapor sensing arrangement and photograph of fabricated sensing device.

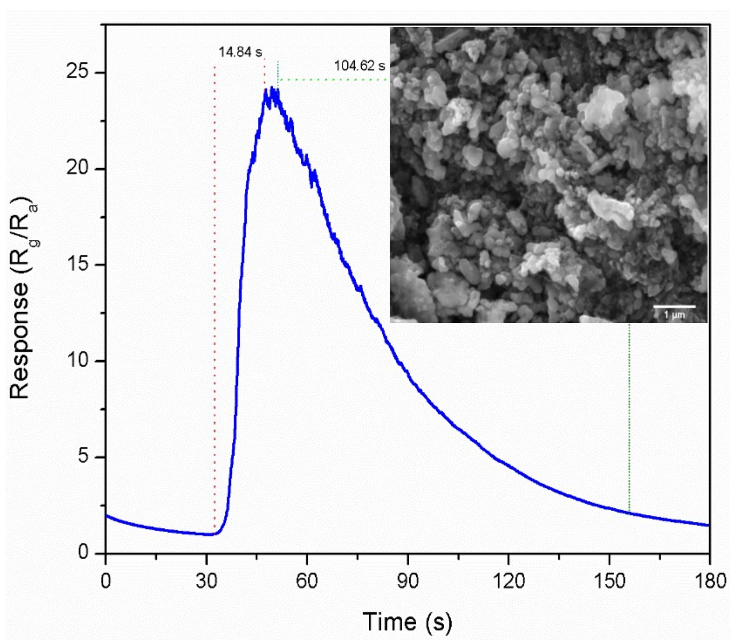


Fig. S3 1 ppm acetone sensing response using irregular $LaFeO_3$ particles at 100 ˚C device and chamber temperatures. (Inset : SEM image of irregular $LaFeO_3$ particles)

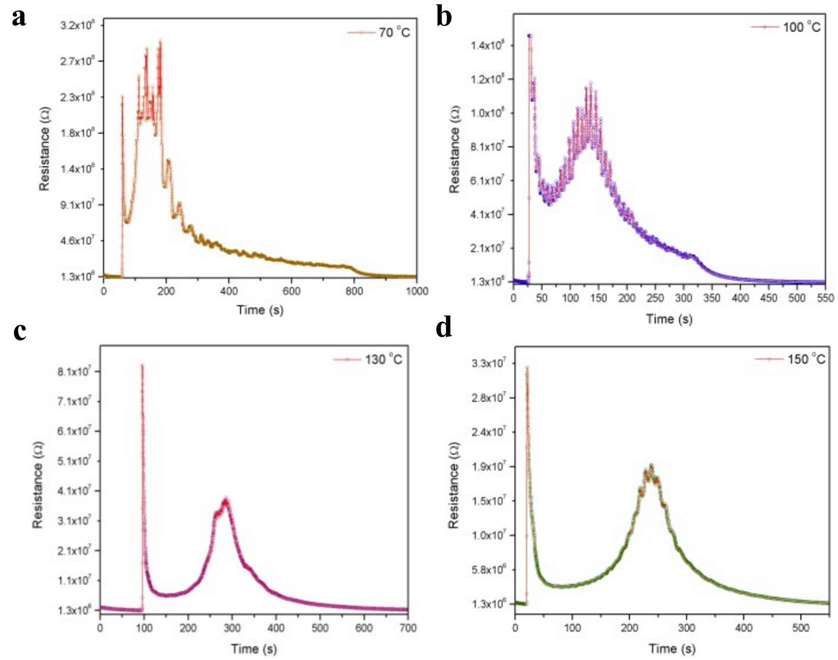


Fig. S4 10 ppm pure acetone sensing response using $LaFeO_3$ dendrites (U9P15) at a) 70 ˚C, b) 100 ˚C, c) 130 ˚C and d) 150 ˚C chamber temperatures with 100 ˚C device temperature.

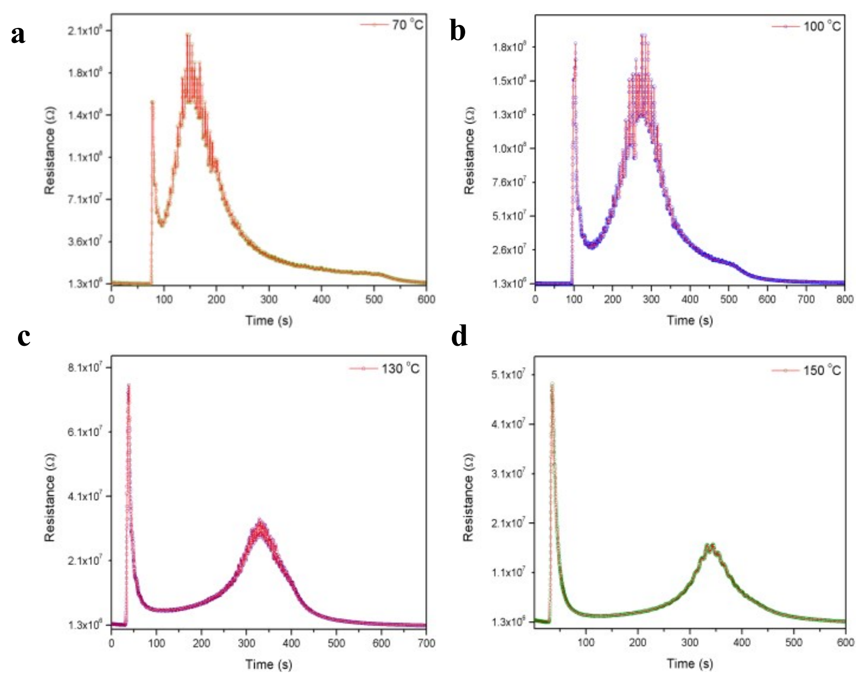


Fig. S5 10 ppm pure ethanol sensing response using $LaFeO_3$ dendrites (U9P15) at a) 70 ˚C, b) 100 ˚C, c) 130 ˚C and d) 150 ˚C chamber temperatures with 100 ˚C device temperature.

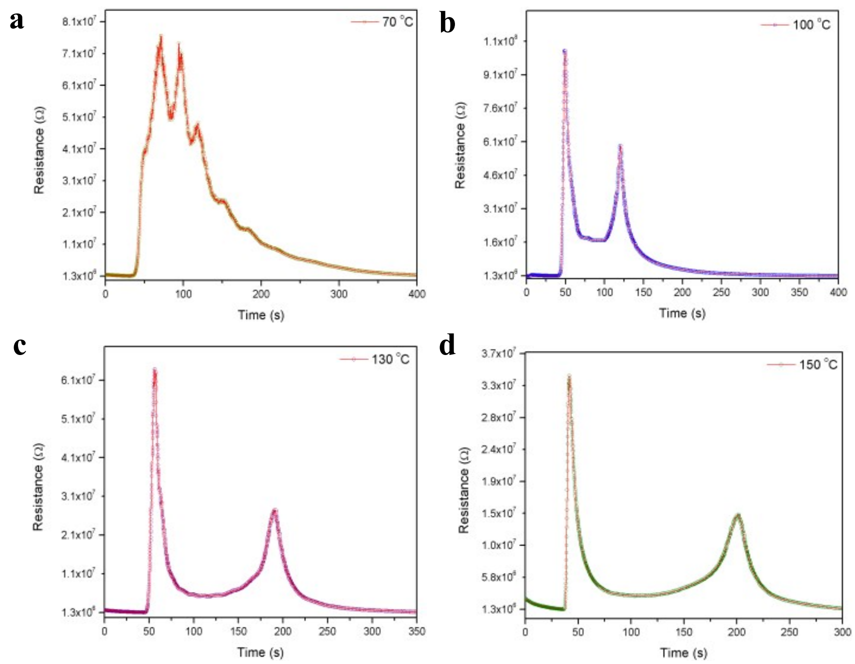


Fig. S6 10 ppm (37 - 41%) formaldehyde sensing response using $LaFeO_3$ dendrites (U9P15) at a) 70 ˚C, b) 100 ˚C, c) 130 ˚C and d) 150 ˚C chamber temperatures with 100 ˚C device temperature.

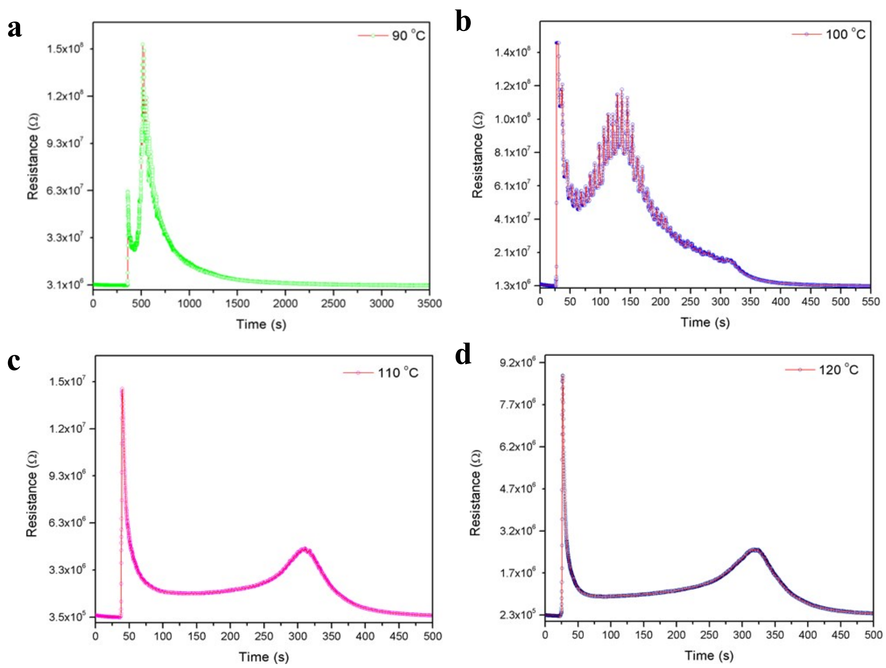


Fig. S7 10 ppm pure acetone sensing response using $LaFeO_3$ dendrites (U9P15) at a) 90 ˚C, b) 100 ˚C, c) 110 ˚C and d) 120 ˚C device temperatures with 100 ˚C chamber temperature.

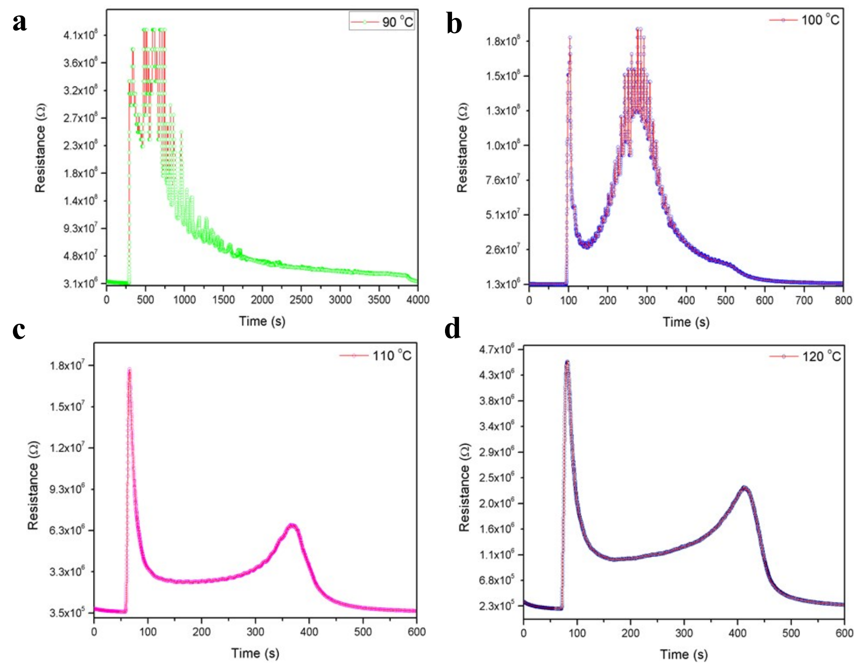


Fig. S8 10 ppm pure ethanol sensing response using $LaFeO_3$ dendrites (U9P15) at a) 90 ˚C, b) 100 ˚C, c) 110 ˚C and d) 120 ˚C device temperatures with 100 ˚C chamber temperature.

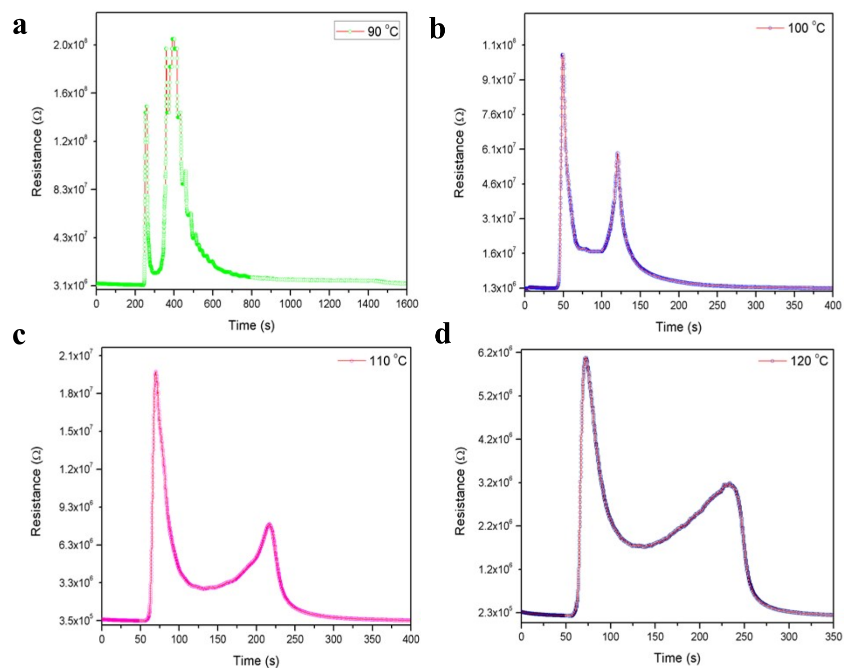


Fig. S9 10 ppm (37 - 41%) formaldehyde sensing response using $LaFeO_3$ dendrites (U9P15) at a) 90 ˚C, b) 100 ˚C, c) 110 ˚C and d) 120 ˚C device temperatures with 100 ˚C chamber temperature.

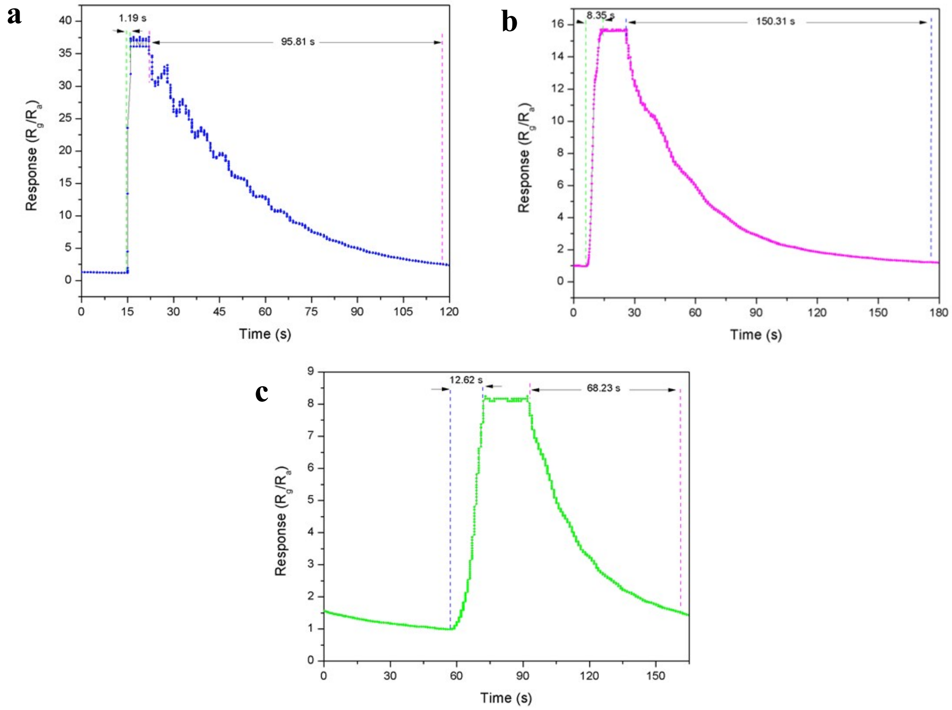


Fig. S10 Response / recovery time of 1 ppm (a) acetone, (b) ethanol and (c) formaldehyde at 100 ˚C device and chamber temperatures.

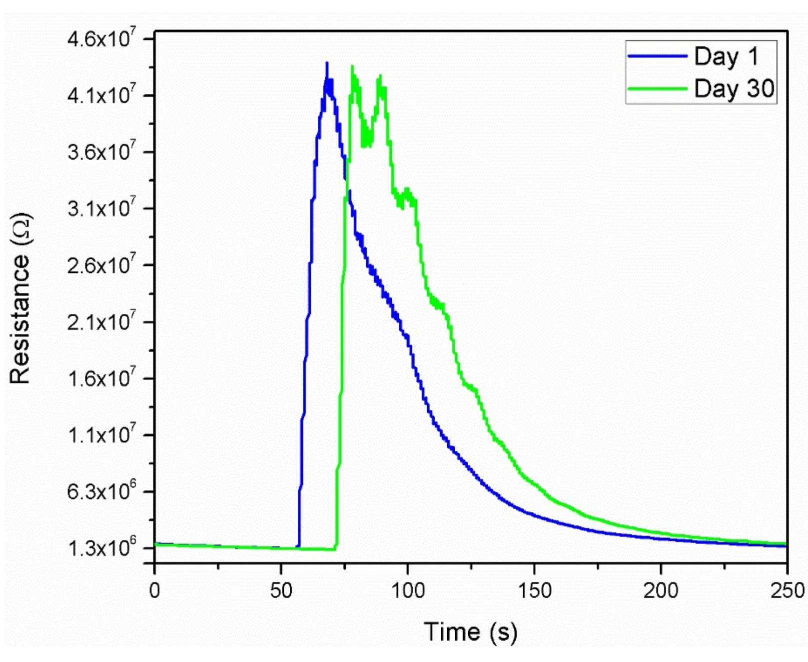


Fig. S11 Comparison of 1 ppm acetone sensing response for day 1 and day 30 using $LaFeO_3$ dendrites at 100 ˚C device and chamber temperatures.

Table S2. Comparison of recently reported acetone sensors with the present $LaFeO_3$ dendrites based device.

Sensing Materials	Concentration [ppm]	Sensing Response $S = R_g/R_a$ or R_a/R_g	$T_{res/rec}$ [s]	Lowest Detection [ppm]	Operating Temperature [˚C]	Ref
3 mol% Co-doped Spongy-like In_2O_3	100	32.8	1.14/37.5	5	240	1
Porous WO_3 Nanofibers	12.5	1.79	33/42	1.8	350	2
3 wt% Pd:$SmFe_{0.9}Mg_{0.1}O_3$ Nanocrystalline Powders	0.5	7.16	32/8	0.01	220	3
Co_3O_4 Core−Shell	200	13	4/8	10	190	4
PdO−NiO/$NiCo_2O_4$ Truncated Nanocages	100	6.7	19/28	10	210	5
Porous Tube-like Au/ZnO	100	280	2/92	1	190	6
0.070 wt% Pt-Functionalized CS-Pt@SnO_2 Nanofiber	1	37.9	12/44	0.1	350	7
Bi_2O_3 Nanostructures	100	41%	315/152	10	27	8
Hollow $NiFe_2O_4$ Microspindles	200	52.8	14.2/>100	5	120	9
MWCNTs/Co_3O_4 Octahedron	100	5.1	-	10	120	10
Multilayer-assembled ZnO Nanoplates	100	21.56	9/51	0.25	230	11
Concave $ZnFe_2O_4$ Hollow Octahedral Nanocages	100	35.5	-	5	120	12
PdO−Co_3O_4 Hollow Nanocages	5	2.51	-	0.4	350	13
PdO−ZnO Composite on Hollow SnO_2 Nanotubes	1	5.06	16/36	0.1	400	14
PtO_2 - SnO_2 Multichannel Nanofibers	5	194.15	<12/-	0.4	400	15
γ-Fe_2O_3 Microrod	100	125.5	0.9/15	10	220	16
$LaFeO_3$ Dendrites	**1**	**37.63**	**1.19/ 95.81**	**0.01**	**100**	**This work**

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