Electronic Supplementary Material (ESI) for Physical Chemistry Chemical Physics.

Electronic Supplementary Information

The influence of manganese doped two-dimensional zinc ferrite thin film for selective trimethylamine chemiresistive gas sensors

Thangavel Ravikumar[a,b], Thirumalaisamy Logu [c], Madanagurusamy Sridharan [d], and Sivaperuman Kalainathan [a*]

[a] Centre for Nanotechnology Research, Vellore Institute of Technology, Vellore, India.

[b] School of Advanced Sciences, Vellore Institute of Technology, Vellore, India.

[c] Dept. of Physics, G.T.N Arts College (Affiliated to Madurai Kamaraj University), Dindigul, India.

[d] Functional Nanomaterials & Devices Lab, Centre for Nanotechnology & Advanced Biomaterials and School of Electrical & Electronics Engineering, SASTRA Deemed to be University, Thanjavur, India.

[*]Corresponding Author

Email: s.kalainathan@gmail.com[*]

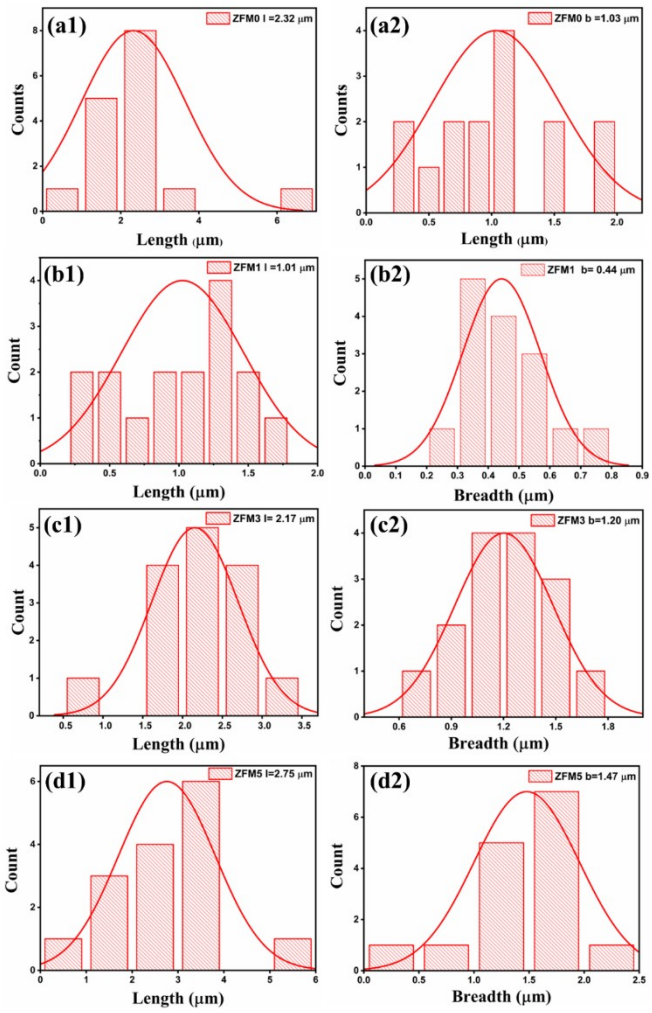

Figure S1.Length and breadth histogram representation of pure and Mn-doped thin films (a1, a2) ZFM0, (b1, b2) ZFM1, (c1, c2) ZFM3, and (d1, d2) ZFM5

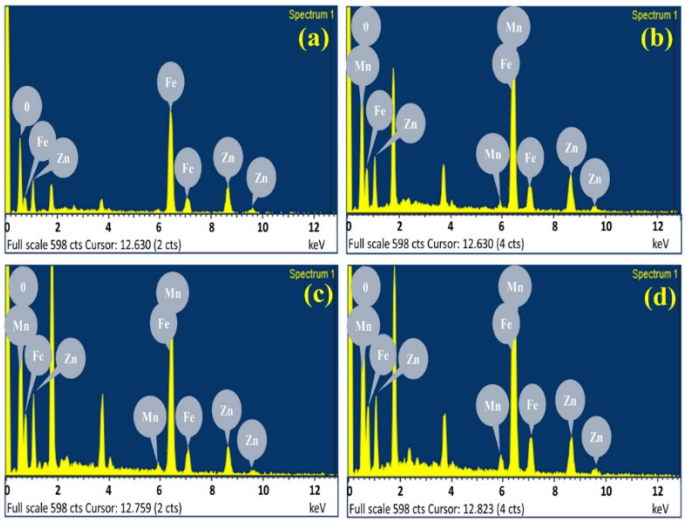

Figure S2. EDX analysis of undoped and Mn-doped ZF thin films (a) ZFM0 (b) ZFM1 (c) ZFM3 and (d) ZFM5.

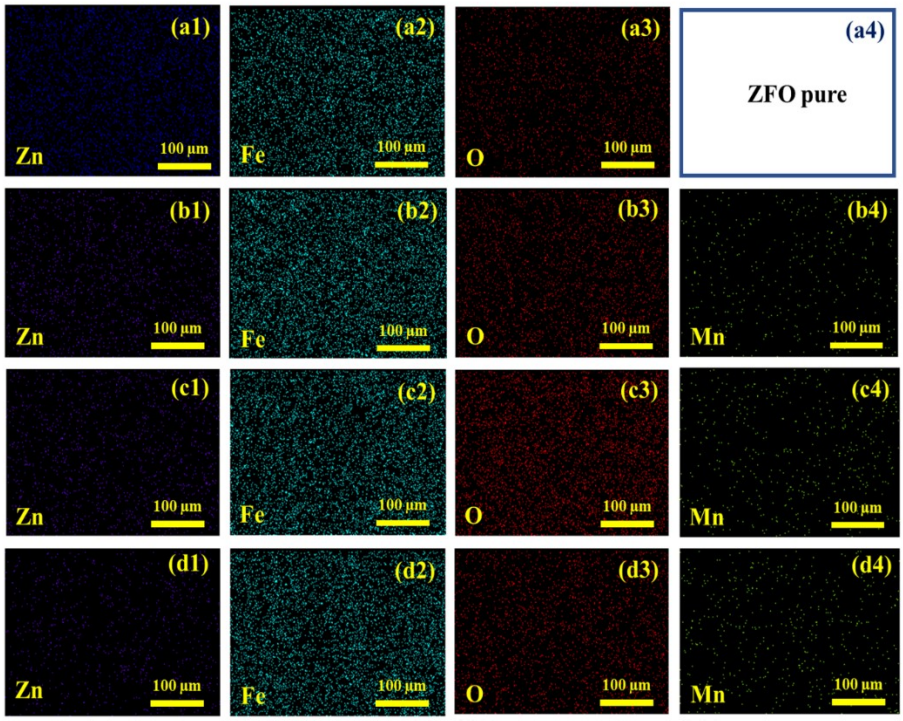

Figure S3. (a1-a3) SEM-EDX elemental mapping for Zn, Fe, O, and Mn elements on substrate temperature ZFM0, (b1-b3) ZFM1, (c1-c3) ZFM3, and (d1-d3) ZFM5 Mn doped ZF thin film.

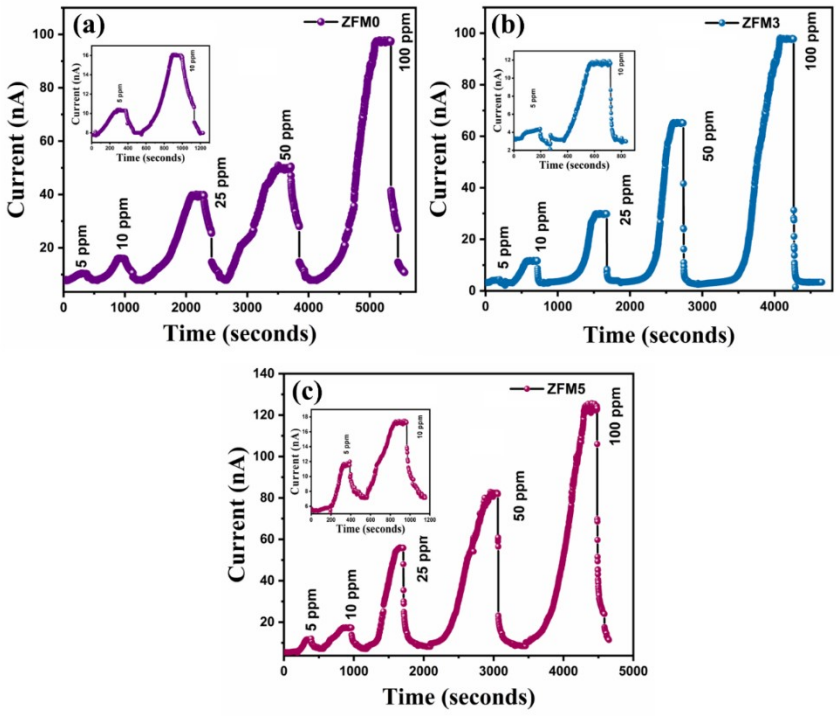

Figure S4. Dynamic response of sample for different concentrations: (a) ZFM0, (b)ZFM1, and (c) ZFM5

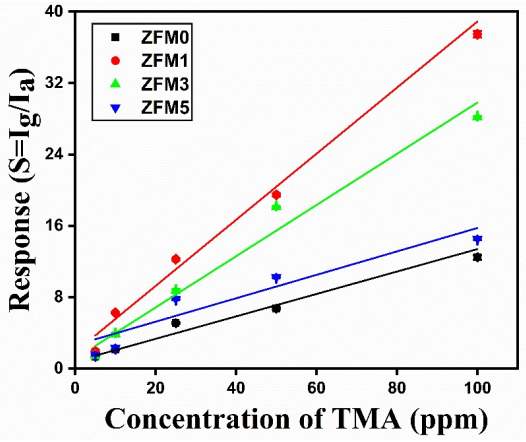

Figure S5. Gas sensing properties of the samples at room temperature: the linear fit curves of responses to different concentrations of TMA.

Calculation of the limit of detection (LOD) of the sensors

To determine the noise level and LOD of the sensors, the sensitivity and root mean square (RMS) deviation at the baseline are employed. The calculation formula is as follows: The response at the baseline, time, and curve is first fitted with polynomials of the fifth order. Consider 11 data

points to calculate the statistical parameters of the fifth-order polynomial fit and the regular residual (y_i-y) at the baseline. The measured data point and the value of the fitted curve are denoted by y_i and y. Following that, the formulas equations (8) and (9) are used to calculate the root mean square deviation (RMS_{Noise}) and LOD. Three separate assessments were used to determine the RMS_{Noise} and LOD.

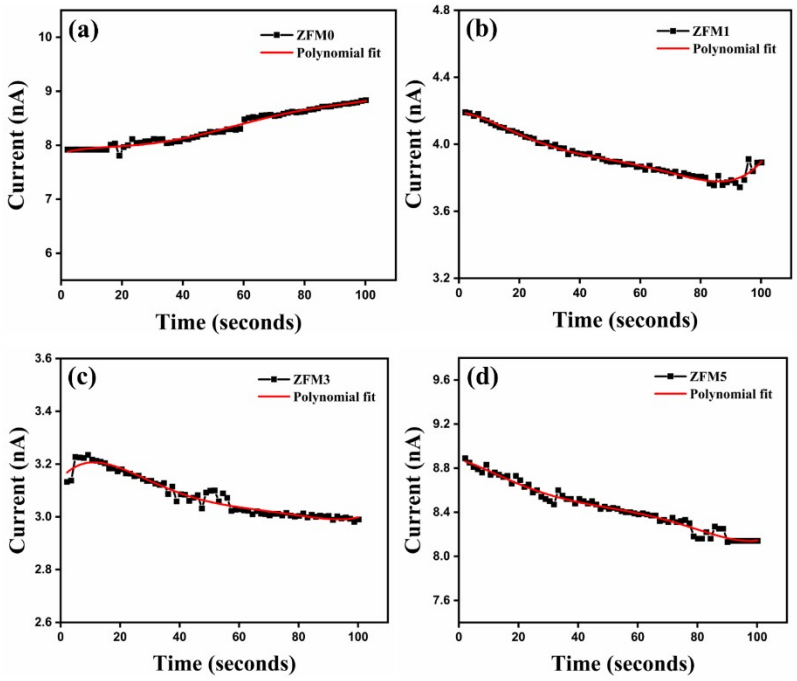

Figure S6. Plots of 5th order polynomial fitted normalized current as a function of time at the baseline before target gas exposure of the sensors: (a) ZFM0, (b) ZFM1, (c) ZFM3, (d) ZFM5.

Table S1. 5th order polynomial fitting data for the ZFM0, ZFM1, ZFM3, ZFM5 sensor.

Sample	V_{χ^2}	RMS_{Noise}	**LOD (ppb)**
ZFM0	1.59E-20	3.98672E-11	9.5
ZFM1	6.61E-22	8.13029E-12	0.6
ZFM3	3.68E-21	1.91776E-11	2
ZFM5	1.57E-20	3.9669E-11	9

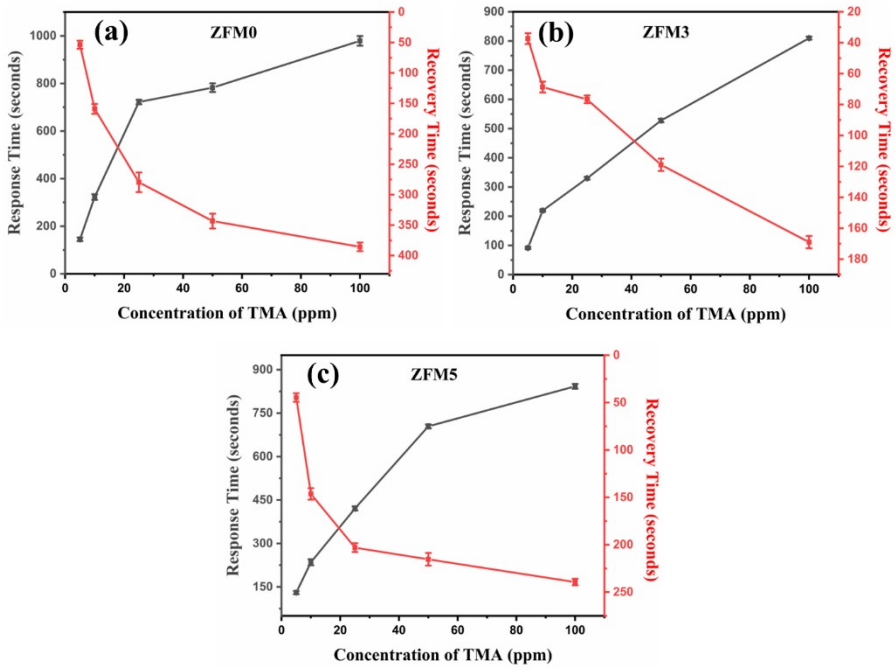

Figure S7. Response/ Recovery times for the samples for various TMA concentrations: (a) ZFM0, (b) ZFM1, and (c) ZFM5