Electronic Supplementary Material (ESI) for Environmental Science: Nano.

Supporting Information

Cations Substitution Effects (Mn, Ni, and Zn) on ZIF-67 derived Spinel Modified with 3DGO for the Detection of NO_2 Gas with High Sensitivity and Selectivity

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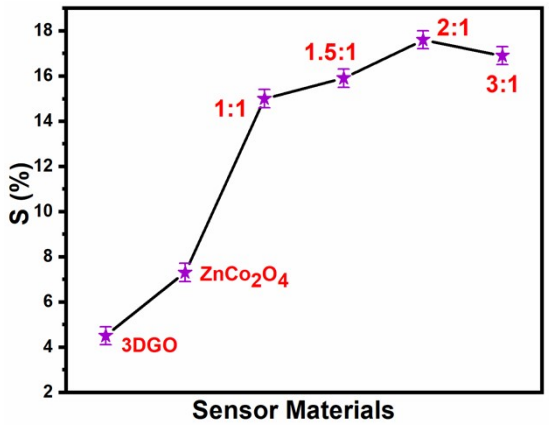

Fig. S1. Effect of 3DGO loading in the composite sensor at room temperature.

Table S1: Specific surface area and pore size of $MnCo_2O_4$, $NiCo_2O_4$, $ZnCo_2O_4$ structures and 3DGO-$ZnCo_2O_4$ composite.

Materials	Surface Area (m^2/g)	Pore size (nm)
$MnCo_2O_4$	71	2.2
$NiCo_2O_4$	78	3.8
$ZnCo_2O_4$	87	4.3
3DGO-$ZnCo_2O_4$	138	6.7

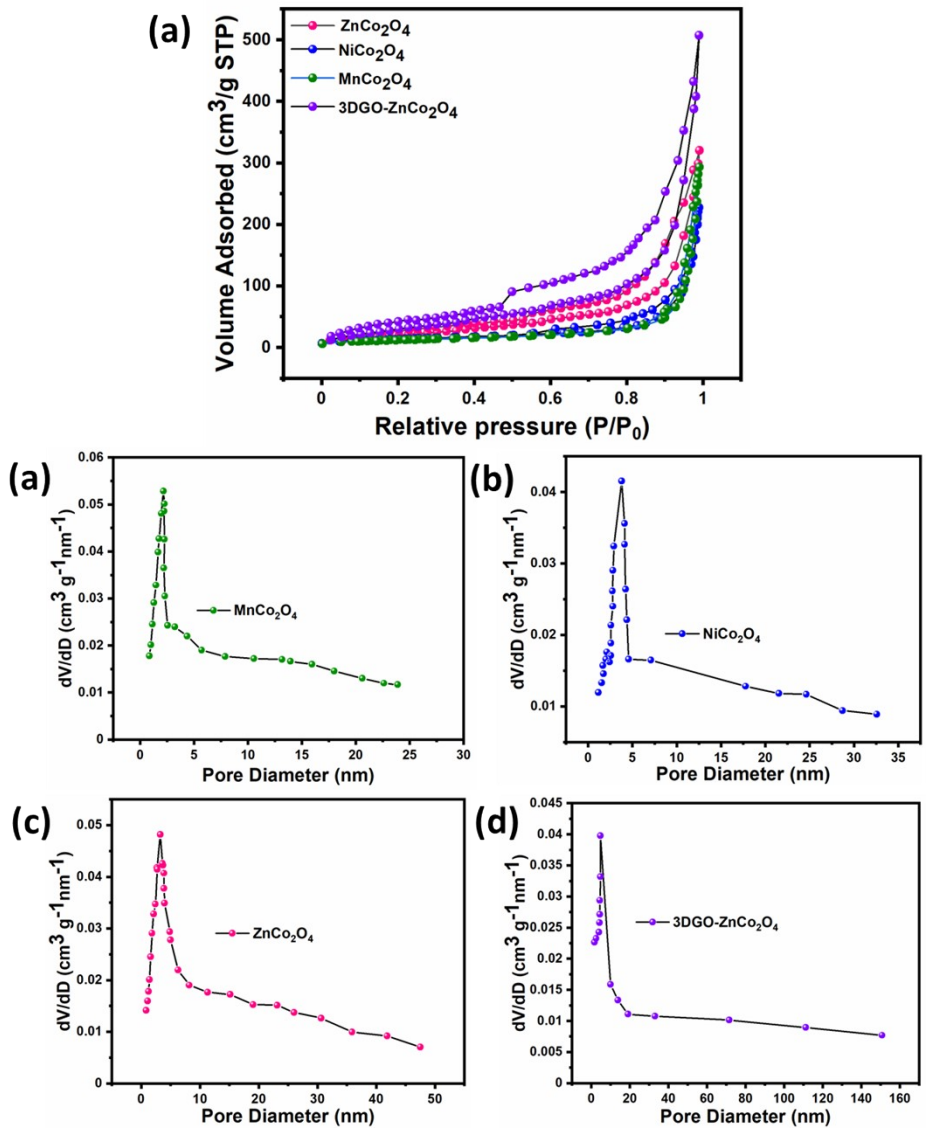

Fig. S2. N_2 adsorption-desorption study and pore size distribution curves of $MnCo_2O_4$, $NiCo_2O_4$, $ZnCo_2O_4$ structures and 3DGO-$ZnCo_2O_4$ composite.

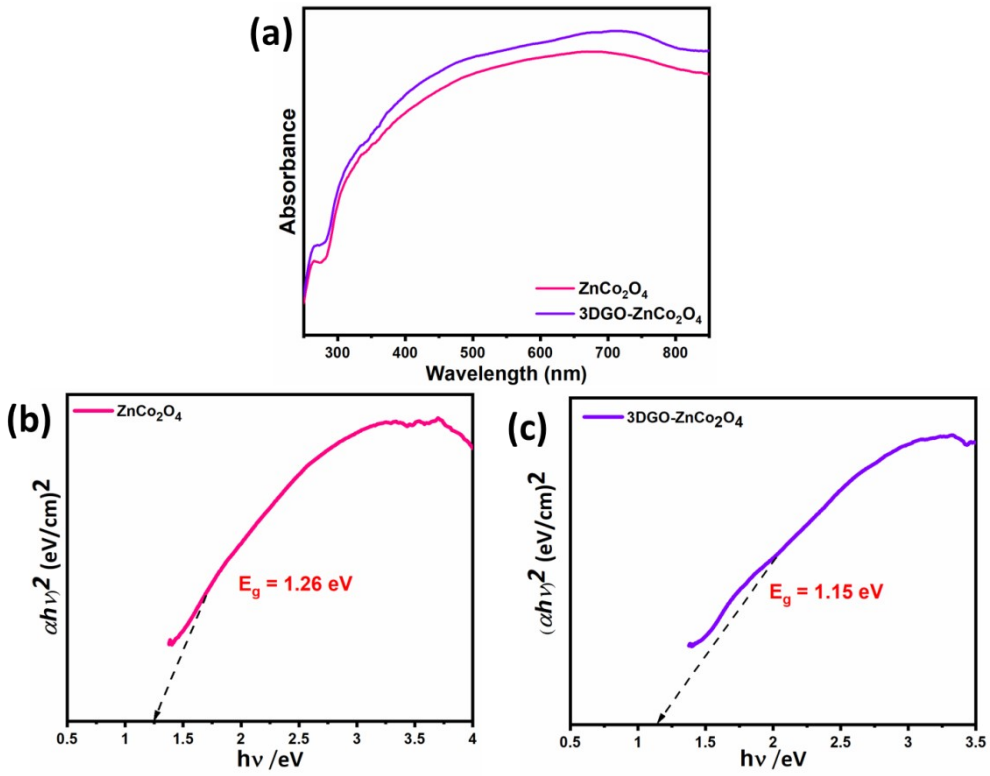

Fig. S3. (a-d) (a) UV–visible absorption spectra, and Tauc plot between $(\alpha h\nu)^2$ vs. photon energy ($h\nu$), of the $ZnCo_2O_4$ and 3DGO-$ZnCo_2O_4$ respectively.

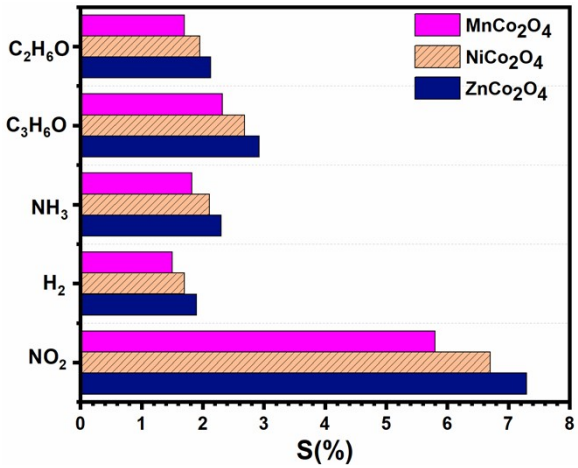

Fig. S4. *Cross-selectivity of $MnCo_2O_4$, $NiCo_2O_4$, and $ZnCo_2O_4$ samples towards various gases.*

Table S2. *Comparison of different materials based sensor for nitrogen dioxide sensing applications.*

Sl No.	Gas sensors	Operating temperature (°C)	Conc. of gas	Sensitivity (%)	Response/ Recovery Time	Ref
1	Co_3O_4/rGO	RT	60 ppm	5	60 s/120 s	1
2	$ZnGa_2O_4$/Graphene	RT	100 ppm	9.8	32 s/41 s	2
3	SnO_2/rGO	RT	100 ppm	1.05	300 s	3

4	p-$NiCo_2O_4$/n-WO_3	150 °C	20 ppm	11.6	13 s/16 s	4
5	MOF-derived porous $NiFe_2O_4$	120 °C	200 ppm	14.27	32 s/ 31 s	5
6	In-SnO_2-rGO	RT	100 ppm	11	400 s/-	6
7	hmc Co_3O_4-g-C_3N_4 NC	RT	60 ppm	17.83	10 s/26.6 s	7
8	In_2O_3/rGO	RT	30 ppm	8.25	240 s/1440 s	8
9	rGO-CNT-SnO_2	50 °C	5 ppm	2.53	8 s/77 s	9
10	$CoFe_2O_4$	150 °C	80 ppm	70	9 s/160 s	10
11	Graphene Aerogel/ZnO	RT	100 ppm	8.9	15 s/17 s	11
12	3DGO/MOF-derived $ZnCo_2O_4$	RT	50 ppm	17.6	7 s/9 s	This study

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