Electronic Supplementary Material (ESI) for Journal of Materials Chemistry C

Supplementary information

Gas sensing response analysis of p-type mesoporous Chromium Oxide thin films

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1. I-V characteristics

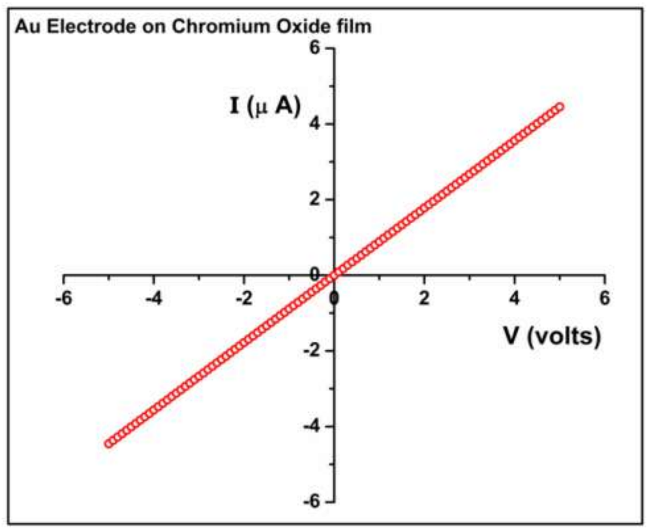

Figure S1. I-V characteristics of Au electrodes on Cr_2O_3 films.

2. X-ray Diffraction

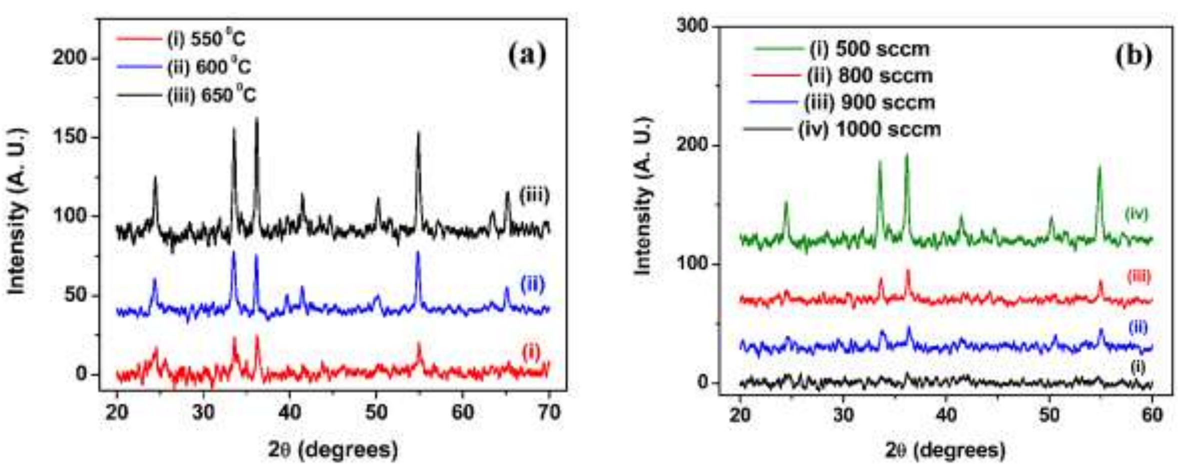

Figure S2.Effect of (a) substrate temperature and (b) carrier flow rate on crystallinity in CM films.

3. Raman Spectroscopy

The micro-raman spectroscopy of the as-deposited Cr_2O_3 films is done in order to characterize the crystallinity and to verify the presence/absence of other impurity phases or residual carbonaceous matter.

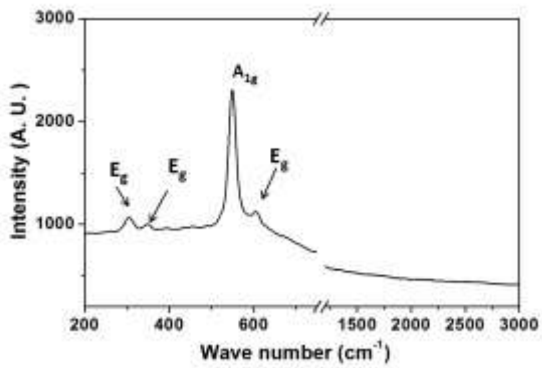

Fig. S3 The micro-raman spectrum of as-deposited film showing one A_{1g} and three E_g modes of rhombohedral Cr_2O_3.

The Raman spectrum is divided into two regions and enlarged. The first region (lower wave numbers) reveals 4 peaks (A_{1g} + $3E_g$ modes) which are attributed to corundum structure of Cr_2O_3. No peaks were found pertaining to CrO_2 or CrO_3 which marks their absence. Further the 2nd region highlights the absence of carbonaceous matter.

Note:
Owing to the diverse nature of experimental setups (static or dynamic) it is difficult to compare the gas sensing properties of chromium oxide sensors developed by various research groups. However, following comparison has been made based on available literature.

Table S1. Comparison between the characteristics of state of the art Cr_2O_3 based sensors

Sr. No	Microstructure	Type of sensing experiment	Test gas and concentration	Typical sensitivity value	Characteristics	Reference
1.	Ordered Mesoporous Cr_2O_3 (Thick films)	Static measurement (Micro syringe injection)	Ethanol 1000 ppm	R_g/R_a = ~13 At T =150 ^oC	No selectivity	Chem. Commun., 2012, **48**, 865–867
2.	Porous Cr_2O_3 nanotubes (Thick films)	Static measurement (Micro syringe injection)	Ethanol 800 ppm	$\Delta R/R_a$ = ~2	High operating temperature >400 ^0C And slower response at temperature <400 ^0C	Nanotechnology **19** (2008) 035504
3.	Cr_2O_3 thick films	Static measurement (Micro syringe injection)	Ethanol 700 ppm	R_g/R_a = ~30	Slower response times (~ 30 s) and recovery time (~150 s)	Sensors and Actuators B **158** (2011) 259–264
4.	Reactively sputtered Cr_2O_3 films	Dynamic flow based method	Ethanol 800 ppm	R_g/R_a = ~2	Slower response and recovery times	Advanced Materials Research **55-57** (2008)285-288
5.	Porous Cr_2O_3 thin films (This work)	Dynamic flow based method	Ethanol 1000 ppm	$\Delta R/R_a$ = ~15	Fairly good response and selective to ethanol.	This work