



Contribution ID: 214

Type: Oral Presentation

## Temperature-dependent gas sensing study of chemically prepared CeO<sub>2</sub>-CuO nanoparticles

Wednesday, 27 June 2018 16:40 (20 minutes)

The combination of nanosized cerium dioxide (CeO<sub>2</sub>) with transition metal oxides, like copper oxide (CuO), containing Ce<sub>1-x</sub>Cu<sub>x</sub>O<sub>2-y</sub>, have received significant attention for their catalytic application due to their economic, environmental, and catalytically favourable properties.[1] These systems proved efficient for selective CO oxidation the water-gas shift (WGS) reactions and the hydrogen combustion reactions.[2] Even though the surface and catalytic properties of the Ce<sub>1-x</sub>Cu<sub>x</sub>O<sub>2-y</sub> systems can be translated to the field of gas sensors, the gas sensing performance of these systems have not yet been investigated.

Therefore, herein, we report for the first time, the gas sensing performance of Ce<sub>1-x</sub>Cu<sub>x</sub>O<sub>2-y</sub> systems towards various gases such as CO, H<sub>2</sub>S, H<sub>2</sub>, CH<sub>4</sub>, NH<sub>3</sub>, ethanol, NO<sub>2</sub> and toluene at various operating temperatures and relative humidity. The influence of the crystallize size, point defects and adsorbed surface oxygen species on the response, selectivity and sensitivity of Ce<sub>1-x</sub>Cu<sub>x</sub>O<sub>2-y</sub> nanoparticles was investigated using X-ray diffraction, transmission electron microscopy attached with electron energy loss spectroscopy, X-ray photo-electron spectroscopy and photoluminescence spectroscopy. The underlying gas sensing mechanism was also examined and discussed.

[1] (a) Putla, S., M.H. Amin, B.M. Reddy, A. Nafady, K.A. Al Farhan, and S.K. Bhargava, ACS Applied Materials & Interfaces, 7, 16525-16535 (2015); DOI: 10.1021/acsami.5b03988; (b) Qin, J., J. Lu, M. Cao, and C. Hu, Nanoscale, 2, 2739-2743 (2010); DOI: 10.1039/c0nr00446d

[2] (a) Bernardi, M.I.B., A. Mesquita, F. Beron, K.R. Pirota, A.O. de Zevallos, A.C. Doriguetto, and H.B. de Carvalho, Physical Chemistry Chemical Physics, 17, 3072-3080 (2015); DOI: 10.1039/c4cp04879b; (b) Elias, J.S., N. Artrith, M. Bugnet, L. Giordano, G.A. Botton, A.M. Kolpak, and Y. Shao-Horn, 6, 1675-1679 (2016); DOI: 10.1021/acscatal.5b02666

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**Session Classification:** Applied Physics

**Track Classification:** Track F - Applied Physics