Advanced Materials for Gas Sensing Applications

E. Gagaoudakis[1#], **G. Kiriakidis**[1,2], **E. Aperathitis**[3], **M. Moschogiannaki**[1,4], **D. Katerinopoulou**[1,2] and **V. Binas**[1,2*]

[1] Transparent Conductive Materials and Devices Lab / IESL / FORTH, Heraklion, Greece

[2] Department of Physics, University of Crete, Heraklion, Greece

[3] Microelectronics Research Group, IESL / FORTH, Heraklion, Greece

[4] Department of Materials Science and Technology, University of Crete, Heraklion, Greece

Presenting author: E. Gagaoudakis, email: mgagas@iesl.forth.gr
* Corresponding author: V. Binas, email: binasbill@iesl.forth.gr

ABSTRACT

The detection of toxic and hazardous gases such ozone (O_3), nitrogen oxides (NO_x) etc. is of great research interest for over five decades, since they can be dangerous for human health. Moreover, gases related to energy such as hydrogen (H_2) and methane (CH_4) must also be detected in the place where they are produced as well as in their storage, for safety reasons. For this, many sensing techniques and materials have been investigated.

In the present work, metal oxide semiconductors, have been synthesized by sputtering technique as well as by solution-based method, in order to detect O_3, H_2 and CH_4, at room temperature, using the conductometric method. In particular, ZnO films were deposited by dc magnetron sputtering on glass substrates and were tested against O_3, showing a high sensitivity, even at ultra-low concentrations of 5 ppb [1]. In addition, rf-sputtered NiO films grown on glass substrates were investigated for H_2 and CH_4 detection [2]. The sensitivity against H_2 was 80%, while for CH_4 was 76%. In contrast, Cu_2O nanocubes were synthesized via an easy and low-cost solution-based method, in powder form. Cu_2O nanocubes (30x30x30 nm) were dispersed and deposited by drop casting on commercial Interdigitated Transducers (IDT) on glass substrates and tested against ozone [3]. Cu_2O nanocubes showed a high sensitivity of 28% at 10 ppb O_3 with fast response and recovery time.

REFERENCES

[1] Katerinopoulou D**.,** Moschovis K**.,** Gagaoudakis E., Aperathitis E., Binas V.**,** Kiriakidis G. 2017. *Madridge Journal of Nanotechnology & Nanoscience*, **2(1)**, 44-52

[2] E. Gagaoudakis, G. Michail, V. Kampylafka, K. Tsagaraki, E. Aperathitis, K. Moschovis, V. Binas, and G. Kiriakidis.2017*Sensor Letters,***15** 1-5

[3] E. Petromichelaki, E. Gagaoudakis, K. Moschovis, L. Tsetseris, T. D. Anthopoulos, G. Kiriakidis and V. Binas. 2019. *Nanoscale Adv.*, **1**, 2009–2017