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Effects of Yttrium Doping on Acetone Sensing Properties of Flame-spray-made SnO_2 Nanoparticles

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Saowalak Homnan[1,a], Anurat Wisitsoraat[2,3,b], Adisorn Tuantranont[2,4,c], Sukon Phanichphant[2,d], Chaikarn Liewhiran[1,2,5*]
[1]Department of Physics and Materials Science, Faculty of Science, Chiang Mai University,Chiang Mai 50200, Thailand
[2]Center of Advanced Materials for Printed Electronics and Sensors, Materials Science Research Center, Faculty of Science, Chiang Mai University, Chiang Mai 50200, Thailand
[3]Carbon-based Devices and Nanoelectronics Laboratory, National Electronics and Computer Technology Center, National Science and Technology Development Agency, Klong Luang, Pathumthani 12120, Thailand
[4]Thailand Organic and Printed Electronics Innovation Center, National Electronics and Computer Technology Center, National Science and Technology Development Agency, Klong Luang, Pathumthani 12120, Thailand
[5]Center of Excellence in Materials Science and Technology, Chiang Mai University, Chiang Mai 50200, Thailand
[a]ppsaowalak.h@gmail.com,[b]anuratwisit@hotmail.com,[c]adisorn.tuantranont@gmail.com,[d]sphanichphant@gmail.com
* Corresponding author's e-mail address: cliewhiran@gmail.com (C. Liewhiran)

Abstract. In the present study, gas-sensing properties of flame-spray-made 0-2 wt% Y_2O_3-doped SnO_2 nanoparticles are systematically and selectively studied for detection of acetone (C_3H_6O) which practically occurred in specific applications. Structural characterizations by electron microscopy, X-ray analysis and nitrogen adsorption further confirmed the formation of loosely agglomerated SnO_2 nanoparticles (5-15 nm) with high specific surface area and highly crystalline tetragonal-cassiterite SnO_2 structure doped with Y^{3+} oxidation states. The gas-sensing properties of undoped SnO_2 and Y_2O_3-doped SnO_2 sensors were systematically tested towards C_3H_6O under atmospheric conditions at the working temperature ranging from 200-350℃. Tested results indicated that the optimal 0.2 wt% Y_2O_3-doped SnO_2 exhibited high responses of ~322 to 400 ppm acetone under exposure at working temperature of 350℃ in dry air compared with undoped one. Moreover, the optimal Y_2O_3-doped SnO_2 sensors evidently displayed high selectivity against various gas/vapor categories including flammable gases, toxic gas and VOCs. Therefore, Y_2O_3-doped SnO_2 sensors are potential for responsive detections of C_3H_6O at ppm-level but with limited selectivity and may be useful for environmental and biomedical applications.

Keywords : n-type Y/SnO_2, Nanoparticles, Acetone, Acetylene, Sensor.

Author: HOMNAN, Saowalak

Co-author: Dr LIEWHIRAN, Chaikarn

Presenter: HOMNAN, Saowalak

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