Contribution ID: **107** Type: **Poster**

Rapid VOC sensors based on electrolytically exfoliated graphene-loaded flame-made La-doped SnO2 composite films

In this work, flame-made SnO2 nanoparticles were systematically studied by doping with 0.1–2 wt % lanthanum (La) and loading with 0.1–10 wt% electrolytically exfoliated graphene for low detection of VOCs gases including acetone (C3H6O) and ethanol (C2H5OH) gases occurred in human breathe. The sensing films were prepared by a spin-coating technique on Au/Al2O3substrates and evaluated to 6-400 ppm acetone and 3-200 ppm ethanol at working temperatures ranging from 150 to 350℃ in dry air. Structural characterizations by electron microscopy, X-ray analysis and raman spectrometry further demonstrated that La doped SnO2 nanostructures had a spheriodal morphology with a polycrystalline tetragonal SnO2 phase, and La was confirmed to form a solid solution with SnO2 lattice while graphene in the sensing film after annealing and testing still retained its high-quality nonoxidized form.Gas-sensing results evidently showed that SnO2 sensing film with optimal 0.5 wt% La-doping concentration exhibited high response of ~1200 toward 400 ppm acetone and ~700 toward 200 ppm ethanol with ultra-high detection speed with very short response time within a few seconds at 350℃. The additional loading of graphene at 0.1wt % into 0.5wt% La-doped SnO2 led to a drastic response enhancement to ~4100 toward 400 ppm acetone at 350℃ and ~1700 toward 200 ppm ethanol at 300℃ with shorted response time. The superior gas sensing performances of La-doped SnO2 nanoparticles loaded with graphene may be attributed to the large specific surface area of the composite structure, specifically the high interaction rate between acetone and/or ethanol vapor and graphene–La-doped SnO2 nanoparticles interfaces and high electronic conductivity of graphene. Therefore, the 0.1wt% graphene loaded 0.5 wt % La-doped SnO2 sensor is a promising candidate for fast, sensitive and selective detection of VOCs. Furthermore, the sensors displayed very high VOCs selectivity against SO2, H2S, NH3, C2H4, C2H4O, CH4 and H2. Therefore, the graphene loaded La-doped SnO2 sensor are potential for responsive and selective detections of VOCs at a threshold limit value (TLV) of permissible legal limit of acetone and ethanol concentration in human's breath which may be essential for drunken driving detection and biomedical applications.

Author: TAMMANOON, nantikan (Chaing mai University)

Presenter: TAMMANOON, nantikan (Chaing mai University)

Track Classification: Nanomaterials & nanostructures