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Low power gas sensors using organic-inorganic nanocomposite for petroilum refineries

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Lower power consumption and higher performance are compelling demands in the electronic systems motivating the search for new materials which are capable of fulfilling these demands. Recently, nanomaterial-based sensor technology has drawn considerable attention towards the development of sensing applications such as H_2S gas sensors. Hydrogen sulfide (H_2S) gas is a colorless, poisonous, and corrosive gas that generates harmful effect on the nervous system of human-being at low concentrations and causes death at higher concentrations. H_2S often results from the bacterial breakdown of organic matter in the absence of oxygen, thus, it exists in natural gas with a percentage up to 90%, and by far the largest industrial route to H_2S occurs in petroleum refineries.In this work, novel H_2S gas sensor has been fabricated using inorganic metal-oxide nanoparticles embedded in polymer membranes of organic material. The copper-oxide nanoparticles are fabricated by colloid microwave-thermal method that enables a precise size control. Different concentrations of nanoparticles and 5% of ionic liquid are added to a solution of PVA to produce polymer membranes. The produced membranes are flexible and having semiconducting properties. The membrane is encapsulated between two electrical electrodes where the top electrode exhibits a grid structure. While applying a constant voltage across the electrodes, the electrical current response signal is measured. The measurements reveal that at low temperatures these sensors are highly sensitive to H_2S gas with low concentrations of 10 PPM. The result revealed that the best response to H_2S gas for all sensors was obtained at 80°C. As a result, the power consumed to heat up the sensor is reduced by almost 90%. The fabricated sensors are very selective to H_2S, and exhibit fast response. Moreover, these sensors are cheap, easy to manufacture and consume less power. Thus, they have the potential to be used for industrial applications in petroleum refineries.

Biography:

Prof. Saleh obtained his Ph.D. in Physics from Indian Institute of Technology-Delhi (India 2001). He is a full professor at UAE University and has 16 years experience in materials characterization, nanodevices fabrication and laser-plasma interactions, His publication record includes about 50 publications in international peer-reviewed journals and more than 25 presentations in international conferences. He is the principle investigator and Co-PI of 14 research projects and supervised several postgraduate students. He is an expert in measuring the optical and electrical properties of nanomaterials using different techniques. He has vast experience in nanoparticles synthesis and sensors fabrication for detecting hazardous gasses.