ITO nanostructures for Sensors

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ABSTRACT

In recent years, interest in hydrogen as an alternative fuel has escalated because it is renewable, abundant, efficient, and unlike other alternatives, provides zero emissions. The product of hydrogen combustion is water, making it the most environmentally friendly fuel. Hydrogen powered buses are already in normal transit service in some of U.S. cities. Moreover, it can also be used as a fuel for solid oxide fuel cells (SOFCs), which in turn, generate direct electricity. On the other hand, in US space program, for launching the space vehicles, NASA is just as concerned about the weight of vehicles fighting Earth's gravity as it is about power during and after the launch. Hydrogen is used by NASA primarily to launch the space vehicles. Hydrogen as a new space vehicle fuel provides an opportunity for both, the reduction or avoidance of polluting emissions and the noise level produced. Due to increased use of hydrogen in recent years in different sectors, development of room temperature hydrogen sensor has become inevitable. Currently, we are mainly focusing on the development of nanostructured transparent indium oxide (In_2O_3) doped-tin oxide (SnO_2) as a room temperature hydrogen sensor. The concentration of oxygen vacancies near the surface is important since they act as n-type donors localized below the conduction band which changes the electrical conductivity of the space charge layer responsible for gas sensing when occupied. Since infrared absorption, for semiconductors, is due to free carriers, a relationship can then be drawn between conductivity and excess oxygen vacancy concentration. The present sensor will be incorporated into a MEMs device to improve its room temperature sensing characteristics. In short, various novel technological approaches to sense hydrogen with high sensitivity and selectivity along with minimum response and recovery time at room temperature are highlighted. (Research is funded by NASA, NSF, ASRC)