Ultra-sensitive hydrogen sensors based on Metal@Metal oxides (M@MOSs) hierarchical nanostructures

Sonalika Agarwal*[1,2], Takayuki Ichikawa[2] and Yeon-Tae Yu[1]

[1]Division of Advanced Materials Engineering, Jeonbuk National University, Jeonju, Republic of Korea

[2] Graduate School of Advanced Science and Engineering, Hiroshima University, 1-3-1 Kagamiyama, Higashi-Hiroshima 739-8527, Japan

Corresponding author* E-mail: sonalika@hiroshima-u.ac.jp

Abstract

The burgeoning demand for sustainable and renewable energy solutions, coupled with the depletion of fossil fuel reserves, has spurred the development of alternative energy storage and conversion technologies. Hydrogen (H_2) has emerged as a promising secondary energy source due to its potential to drive sustainable energy development. In recent years, there has been a significant increase in the utilization of H_2, particularly in the automotive industry and energy conversion applications, such as transportation fuel cells. However, the widespread use of H_2 necessitates the implementation of robust systems for the rapid detection of hydrogen leaks to prevent hazardous conditions. Ensuring the safe utilization of H_2 requires the development of highly sensitive and selective sensors capable of detecting minute quantities of hydrogen leakage. Therefore, there is an urgent need to engineer high-performance, cost-effective, durable, and power-efficient sustainable hydrogen sensors. One promising approach involves leveraging multifunctional Metal@Metal oxides (M@MOSs) hierarchical nanostructures to address practical application requirements. Metal@Metal oxides (M@MOSs) offer several advantages for hydrogen sensing applications, including enhanced sensitivity, selectivity, and stability. The hierarchical nanostructures provide a large surface area and facilitate efficient gas-surface interactions, resulting in improved sensor performance. Moreover, the integration of metal and metal oxide components enables synergistic effects, enhancing the overall sensing capabilities of the system.

By harnessing the unique properties of multifunctional Metal@Metal oxides nanostructures, researchers can develop innovative sensing solutions that contribute to the realization of a sustainable energy future.

Keywords: Metal oxide nanostructures, noble metals, alloys, ZnO, hydrogen sensor