Sensors and Actuators B: Chemical

Ultra-high sensitive and selective H_2 gas sensor manifested by interface of n–n heterostructure of CeO_2-SnO_2 nanoparticles

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Abstract:

Detection of toxic and explosive gases in a selective manner and with higher sensitivity in industries and homes remains very challenging. Therefore, herein, we report on the ultra-high sensitive and selective hydrogen gas sensing using CeO_2-SnO_2 mixed oxide heterostructure synthesized by a simple hydrothermal method. The BET, photoluminescence, X-ray photoelectron spectroscopy and electron paramagnetic resonance analyses demonstrated that the CeO_2-SnO_2 heterostructure comprehends a high surface area and a large number of defects related to oxygen vacancies. The formation of heterojunction in CeO_2-SnO_2nanostructures was confirmed by the non-linear behaviour I–V curve. The gas-sensing characteristics of the CeO_2-SnO_2 heterostructure showed shorter response and recovery times of approximately 17 and 24s, respectively, together with high sensitivity (19.23 ppm^{-1}) to 40.00 ppm H_2 gas at 300°C. The improved H_2 gas sensing response of 1323 at 60 ppm H_2 gas is correlated with the higher surface area, pore diameter, surface defects and CeO_2-SnO_2heterojunction emerging at the interfaces between the CeO_2 and SnO_2 serves as additional reaction sites and as well as exposed facets creating the surface to be extremely reactive for the adsorption of oxygen species. The high H_2 gas selectivity observed for the CeO_2-SnO_2makes them possible candidates for monitoring H_2gas at low concentrations (ppm levels).