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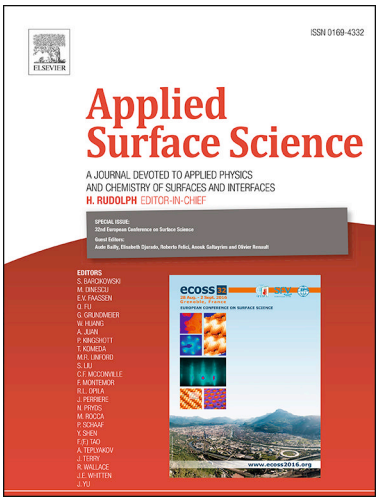


Full Length Article

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# ZIF-8 derived hexagonal-like α-$Fe_2O_3$/ZnO/Au nanoplates with tunable surface heterostructures for superior ethanol gas-sensing performance

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## Abstract

A series of hexagonal-like α-$Fe_2O_3$/ZnO/Au nanoplate heterostructures with tunable morphologies and superior ethanol gas-sensing performance were successfully synthesized via the facile multi-step reaction processes. Hexagonal-like α-$Fe_2O_3$ nanoplates with uniform size around 150 nm are employed as new sensor substrates for loading the well-distributed ZnO and Au nanoparticles with adjustable size distribution on the different surfaces. Brunauer-EmmeQ-Teller (BET) surface areas of α-$Fe_2O_3$ and α-$Fe_2O_3$/ZnO samples are evaluated to be 37.94 and 61.27 $m^2$/g, respectively, while α-$Fe_2O_3$/ZnO/Au composites present the highest value of 79.08 $m^2$/g. These α-$Fe_2O_3$-based functional materials can exhibit outstanding sensing properties to ethanol. When the ethanol concentration is 100 ppm, the response value of α-$Fe_2O_3$/ZnO/Au composites can reach up to 170, which is 14.6 and 80.3 times higher than that of α-$Fe_2O_3$/ZnO and pure α-$Fe_2O_3$, respectively. The recycling stability and long-time effectiveness can be availably maintained within 30 days, as well as the response and recovery times are shortened to 4 and 5 s, respectively. Significantly, the response value of α-$Fe_2O_3$/ZnO/Au composite is still up to 63 at an operating temperature of 280 ˚C even though the ethanol concentration decreases to