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Highly selective and ultra-low power consumption metal oxide based hydrogen gas sensor employing graphene oxide as molecular sieve

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Abstract

The excellent gas sensing performance of metal oxide based nano- and microstructures, including a fast response time and good sensitivity, is typically limited by their low selectivity. Therefore, novel approaches and strategies are required to gain a precise control of the selectivity. Here, we introduce a nanoporous few-layer graphene oxide (GO) membrane with permeability only to specific gas molecules to improve the selectivity of individual zinc oxide microwires (ZnO MWs) toward hydrogen (H2) gas. The fabricated GO-covered ZnO MWs showed ultra-low power consumption (60–200 nW) and an excellent room temperature H2 gas sensing properties with fast response (114 s) and recovery (30 s) times, and a low detection limit of ~4 ppm, while no gas response was measured to all other tested gases. As proposed, the gas sensing mechanism is based on selective sieving of H2 gas molecules through the GO membrane and further diffusion to the Schottky contacts, resulting in a decreased barrier height. Being based on a bottom-up fabrication approach, the presented results could have great potential for further technological applications such as high-performance and highly selective ultra-low power metal oxide-based gas sensors,

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opening new opportunities for the design of nanosensors and their integration in wireless and portable devices.