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Low-power, multiplexed MEMS gas sensor array by local liquid phase reaction

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One dimensional (1D) nanostructures of metal oxides and their derivatives are very useful for the gas sensing applications due to their high sensitivity, quick response, and responsiveness to a wide range of target gases. However, their controlled integration on low-power and ultra-compact MEMS micro-heating platform has been very challenging due to the difficulty of their handling and manipulation, as well as poor controllability and low throughput of device integration. We have developed a novel method for the direct synthesis and facile in-situ integration of 1D metal oxide nanostructures and their derivatives via localized hydrothermal synthesis, selective surface modification, and liquid phase deposition for the chemical conversion [1-3]. In this talk, we would like to present two recent achievements based on this technology. First, a low-power chemoresistive MEMS gas sensor array consisting of four suspended MEMS strip type microheaters and locally synthesized 1D nanomaterials (ZnO nanowires, ZnO/SnO2 core-shell nanotubes, Pt coated ZnO nanowires, and Pt coated ZnO/SnO2 core-shell nanotubes) is explained. By taking advantage of ultra-small thermal mass of sensing region and high surface area of sensing materials, low-power (sub-5mW) and highly selective multiplexed gas sensing for H2 and H2S gases has been realized. Second, we have developed a catalytic combustion sensor array consisting of suspended MEMS strip type microheaters and locally synthesized 1D nanomaterials (ZnO nanowires and Pt nanotubes). By taking advantage of high catalytic activity of Pt nanotubes and ultra-small thermal mass, we could realize a low power, quickly responding, and selective catalytic combustion sensor for H2 gas.

Summary

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