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Prussian Blue analogue derived porous $NiFe_2O_4$ nanocubes for low-concentration acetone sensing at low working temperature

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Abstract

Real-time detection of acetone vapor at low concentration plays a decisive role in early noninvasive diagnosis of diabetes. In this work, porous $NiFe_2O_4$ crystalline nanocubes have been scalably prepared via an as-developed cost-efficient and facile strategy, which involves a morphology-inherited annealing treatment of single-resource Prussian Blue analogue of $Ni_3[Fe(CN)_6]_2 \cdot xH_2O$ solid nanocubes as self-sacrificial templates. The porous $NiFe_2O_4$ crystalline nanocubes are demonstrated to be composed of primary nano building blocks and interconnected pores. When utilized as sensing materials, the as-synthesized $NiFe_2O_4$ exhibited p-type gas-sensing behavior that the resistance increases in a reducing gas atmosphere. Furthermore, the as-fabricated $NiFe_2O_4$ sensor was sensitive and selective to acetone gas with an obvious response value of 1.9 at its low concentration (1 ppm) and low detection of limit (0.52 ppm) at a quite low working temperature (160 ℃). In addition, the sensing mechanism is deeply investigated. More significantly, our prominent findings herein shed light on the fabrication of metal oxide based gas sensors in environmental and medicinal fields.

Key words: acetone; gas sensor; $NiFe_2O_4$ nanocubes; low concentration; Prussian Blue analogue