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Abstract

Low-Dimensional Composite Material Based on Modified Graphene and Metal Oxide for High-Performance Chemical Sensors †

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Low-dimensional chemical sensors based on metal oxides have received great attention for the applications in security and medical diagnoses. Transition oxide nanomaterials exhibit promising sensing performance owing to their large surface area and good chemical stability. However, the sensing performance of these materials have yet to reach to their full potential in capabilities and usage. The fabrication of composite materials based on metal oxides is an effective way to enhance their sensing properties. TiO_2 nanotubes (TNTs) have received extensive attention for gas sensing applications due to their large surface area, unique physical and chemical properties. Graphene with its modified forms, high specific surface area and excellent electronic properties can revolutionize performances of the functional devices. Herein, we report an efficient strategy to improve the sensing properties of TNTs. We fabricated composite structures by coupling of TNTs and modified-graphene. The morphological, structural and elemental analyses of samples were carried out. The sensing properties of obtained materials were tested towards H_2, NH_3, CO, ethanol and acetone (Figure 1). We studied the effect of each material on the sensing performance of composite structures. The studies have shown the variation of mixture material concentration and the modification of graphene layers have a crucial effect on the response and the selectivity of the obtained composite materials. The obtained results demonstrate that we have developed an efficient method for the preparation of composite structures and the obtained materials can be applied for the fabrication of high-performance sensing systems.

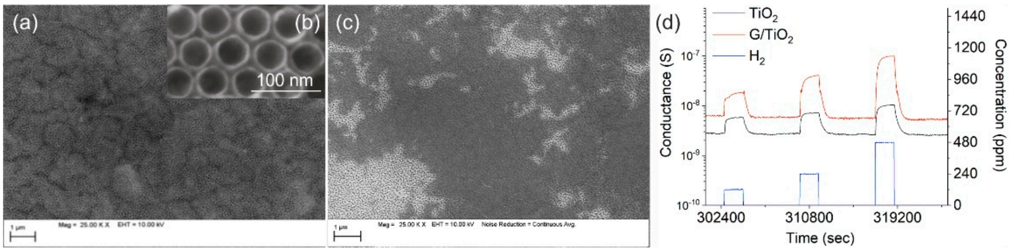

Figure 1. (**a**,**b**) SEM images of the TNTs, (**c**) SEM micrograph of the composite (G/TiO_2), (**d**) dynamical response of the composite (G/TiO_2) and pure TNTs towards 120, 240 and 480 ppm of H_2 at 300 °C.