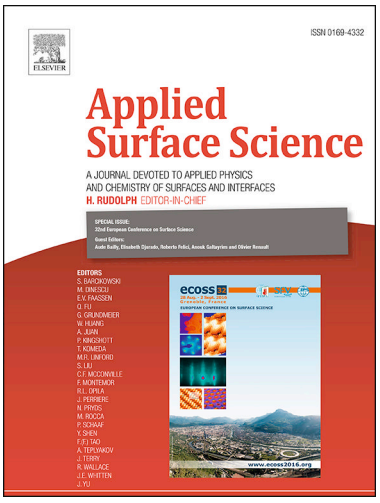

Full Length Article

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Two-dimensional WS_2-based nanosheets modified by Pt quantum dots for enhanced room-temperature NH_3 sensing properties

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Abstract

As a typical two-dimensional (2D) layered transition metal dichalcogenides (TMDs), tungsten disulfide (WS_2) has been considered as a promising sensing material for room-temperature NH_3 detection. However, the bulk WS_2-based room-temperature NH_3 sensors can hardly recover to its initial state after turning off gas. Although the recovery rate of bulk WS_2 was accelerated by thinning method, the response of few- or monolayer WS_2 nanosheets (NSs) to NH_3 was sharply decreased. Here, in premise of keeping fast recovery rate, few- or monolayer WS_2 NSs modified with Pt quantum dots (QDs) were prepared for room-temperature NH_3 detection, which exhibited significantly enhanced sensing properties with fast recovery speeds. Especially, the response of nanocomposite to 250 ppm NH_3 is nearly 10 times than that of WS_2 NSs, which could be attributed to the significantly decreased initial conductivity caused by electrons flowing from higher Fermi level of Pt QDs to that of WS_2 NSs and the higher catalytic activity. Furthermore, the Pt-S bonds confirmed by XPS results could benefit electrons transfer between the interface. We hope that the 0D/2D heterostructure system in this work could provide a direction to improve sensing properties of 2D TMDs-based room-temperature sensors.

Keywords：