GAS SENSOR PERFORMANCES OF α-MoO_3 BELTS NANOSTRUCTURED WITH Pd

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Molybdenum trioxide (MoO_3) due to its unique physical and chemical properties is one of the most attractive candidates for different promising technological applications [1]. α-MoO_3 has a unique morphology that resembles a structure of layered graphene [2]. Due to the layered structure and high chemical stability MoO_3 is used for such applications as gas sensors, recording or storage materials, lubricants, electrochromism, and fotochromism [3]. Meanwhile, MoO_3 is a promising material for catalysts [4], the field emission, light emitting diode, and energy storage elements [5], etc., because of its electrical and optical propierties. Nanobelts shaped nanostructures of MoO_3 are of major interest due to various gas properties and simple integration technology for bottom-up and the possibility of obtaining cost-effective technologies. Their major drawback is the high surface-to-volume ratio. The increased gas response was obtained by nanostructuration of α-MoO_3 nanostructure surface with an aqueous solution of $PdCl_2$ presented in our previous work [6].

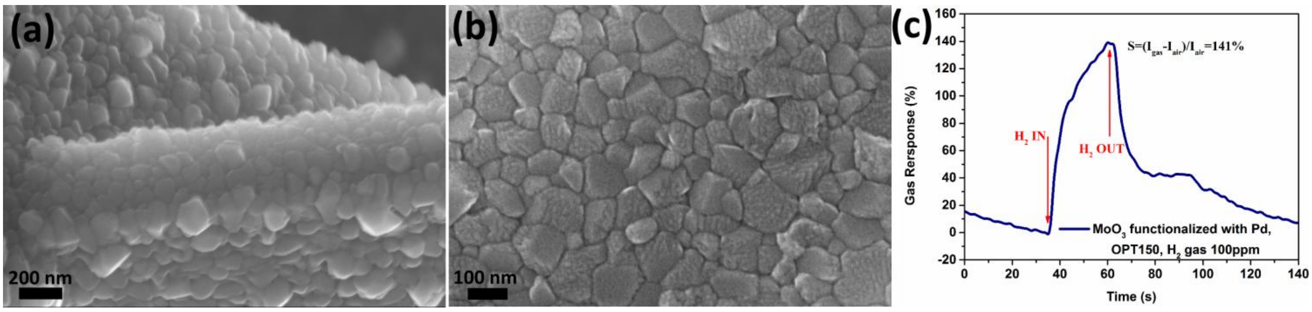

Figure 1. (a) The SEM images of the nanogranulate belts Pd / α-MoO_3 with scale bar of 200 nm; (b) The SEM images of the nanogranulate belts Pd / α-MoO_3 after the application of hydrogen gas tests; (c) Gas response measurements to hydrogen gas of nanostructured Pd / α-MoO_3.

In Figure 1 (a) is provided the surface after the chemical reaction with aqueous $PdCl_2$ solution. The belts surface of α-MoO_3 becomes nanostructured by forming nanocrystallites or nanogranulates. Layered morphology of the belts is not modified by reaction with $PdCl_2$ and obvious changes in morphology of α-MoO_3 belts was not observed. It was observed that after the reduction with hydrogen in Figure 1 (b), the surface concentration of the Mo^{6+}, decreases greatly by reducing of Mo^{5+} and the Mo^{4+}. H^+ ions interact mainly with oxygen atoms double coordinated from network, leading to the formation of hydrogen molibdenum bronze ($HxMoO_3$) and MoO_3 substoichiometric (MoO_3-x). Response to H_2 gas is calculated using the formula $S=((I_{gaz}-I_{air})/I_{air})*100\%$ thereby obtaining a response of 141% at operating temperature of 150 °C, response time 17 s and the partial recovery time is 9 s. The samples did not demonstrate a full recovery of the signal due to changes in surface morphology.

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