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Abstract

Tungsten Oxide Based Hydrogen Gas Sensor Prepared by Advanced Magnetron Sputtering †

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Abstract: In this study, we demonstrate the advantages of two advanced sputtering techniques for the preparation of a thin-film conductometric gas sensor. We combined tungsten oxide (WO_3) thin films with other materials to achieve enhanced sensorial behavior towards hydrogen. Thin films of WO_3 were prepared by the DC and HiPIMS technique, which allowed us to tune the phase composition and crystallinity of the oxide by changing the deposition parameters.Then, the second material was added on-top of these films. We used the copper tungstate $CuWO_4$ in a form of nano-islands deposited by reactive rf sputtering and Pd particles formed during conventional dc sputtering.The specimens were tested for the response to a time-varied hydrogen concentration in synthetic air at various temperatures. The sensitivity and response time were evaluated. The performance of individual films is presented as well as the details of the synthesis.Advanced magnetron techniques (such as HiPIMS) allow us to tune the property of the film to improve the sensorial behavior. The method is compatible with the silicon electronics industry, which consists of a few steps that don't require any wet technique and films can be used in an as-deposited state. Therefore, sensorial nanostructured materials prepared by magnetron sputtering are very suitable for use in miniaturized electronic devices.

Keywords: hydrogen sensor; copper tungstate; tungsten oxide; magnetron sputtering; nanostructures; HiPIMS