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Substoichiometric Tungsten Oxide Films for Hydrogen Gas Sensing

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Tungsten oxide (WOx) is an oxide with a wide range of applications. Besides the most explored fields of use, such as electro- and/or thermochromic behavior, WOxis also often studied for its photocatalytic and sensorial properties. Here we present the study of thin films of tungsten oxide deposited by reactive magnetron sputtering.
Sputtering conditions of the tungsten oxide films were tuned to vary crystallographic phase, texture and chemical composition. The prepared films were characterized by means of X-ray diffraction, scanning electron microscopy and atomic force microscopy. The stoichiometry was determined by energy and wave dispersive spectroscopy.
Subsequently, the films were examined for their sensorial response when assembled into a conductometric sensor. For sensorial measurements hydrogen was chosen as a reactive gas. Therefore, noble metal catalysts (Pd, Pt) were used to support the response.
The layers were tested for response to a time-varied hydrogen concentration in synthetic air at various temperatures. Response sensitivity and response time were evaluated.
An optimization of the deposition, e.g., by changing the substrate tilt and the film thickness, can result in sensorial properties which are almost comparable with those of nanostructured tungsten oxide (nanorods, nanowires etc.), yet the sputtering deposition is a simpler, more tunable and more stable process than methods commonly used for manufacturing of nanostructure-based devices. Moreover reactive magnetron sputtering enables us to tune the stoichiometry unlike other methods.

Keywords
reactive magnetron sputtering
tungsten oxide
nanostructured
hydrogen sensor