New insights into the use of undoped and doped WO_3

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Tungsten oxide is a versatile material with large availability and low fabrication costs, therefore being suitable for various applications. WO_3 possesses very interesting properties, such as relatively narrow bandgap (2.7 - 3.1 eV), good electric transport and high chemical stability. Its favourable semiconducting properties led to intensive use in the fields of photocatalysis, pH sensing or electrochromism. To achieve an enhanced outcome of a desired feature, WO_3 is commonly mixed with other chemical element/s. Employing combinatorial material science enables to screen out the best ratio between two or more oxides in a systematic approach.

Thin film combinatorial libraries were fabricated by different physical vapour deposition techniques such as sputtering or thermal co-evaporation, and as a function of the desired application, different chemical elements were used together with WO_3. Nickel, iron, or cobalt oxides were co-evaporated together with tungsten oxide to discover materials with enhanced photocurrents by photoelectrochemical studies employing Photoelectrochemical Scanning Droplet Cell Microscopy (PE-SDCM). Mixed oxides from molybdenum - tungsten system were obtained either by oxidizing thin film material libraries obtained *via* co-sputtering of metallic Mo and W, or in powder form by chemical synthesis. Antibacterial properties against *Escherichia coli* were investigated, the compositions of interested were screened out and the antibacterial mechanism *via* medium self-acidification was proven. Sensors for pH measurements were developed using electrochemically grown tungsten oxides or by powder mixed with nafion, with the goal to enable the characterization of extremely small volumes [1]. All these examples demonstrate the versatility of WO_3 for current and future use.

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[1] C. C. Mardare, A. W. Hassel, "Review on the Versatility of Tungsten Oxide Coatings", *Phys. Status Solidi A* (2019) *in press* DOI: 10.1002/pssa.201900047