Growth of $Hf_{1-x}Mo_xO_2$ thin films by co-sputtering process aiming their application as a CO_2 gas sensor

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Hafnium dioxide (HfO2) has emerged as a pivotal material in various technological domains, such as in gas sensing applications. Its remarkable properties, such as a high dielectric constant [1], render it proficient in storing significant electrical energy under the influence of an electric field. This attribute proves invaluable in capacitive gas sensors, where alterations in dielectric constant owing to gas adsorption can be discerned. Moreover, HfO2 exhibits commendable thermal and chemical stability, ensuring the preservation of its structural integrity and sensing efficacy even at elevated temperatures a requisite for dependable gas sensing applications. Doping HfO2 with molibdenio (Mo) yields a solid solution termed Hf1-xMoxO3, wherein 'x' denotes the Mo doping concentration. This formulation presents a promising platform for advancing gas sensor technologies, offering enhanced sensitivity, selectivity, stability, and compatibility. Consequently, it stands as a compelling contender in meeting the escalating demand for dependable gas detection methodologies. In this study, we undertake the deposition of Hf1-xMoxO3 via co-sputtering deposition (using Hf and Ti targets), adjusting the Ti concentration by varying the positioning of the Ti target. We comprehensively investigate the structural, morphological, optical, and electrical properties of the resulting thin films. Furthermore, to assess its potential efficacy in gas detection, particularly towards CO2, we conduct preliminary tests. Our findings indicate a promising response to CO2, underscoring the potential of Hf1-xMoxO3 as a robust gas sensing material.

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References

[1] Writam Banerjee, Alireza Kashir, and Stanislav Kamba, Hafnium Oxide (HfO2) – A Multifunctional Oxide: A Review on the Prospect and Challenges of Hafnium Oxide in Resistive Switch