

Nanotechnology, Volume 30, Number 23

Vahl Alexander¹, Dittmann Josephine¹, Jetter Justin¹, Veziroglu Salih¹, Shree Sindu¹, Ababii Nicolai², Lupan Oleg^{1,2}, Aktas Oral Cenk¹, Strunskus Thomas¹, Quandt Eckhard¹, Adelung Rainer¹, Sharma Smita K.³, Faupel Franz¹

¹ University of Kiel,

² Technical University of Moldova,

³ Malaviya National Institute of Technology Jaipur

DOI: [10.1088/1361-6528/ab0837](https://doi.org/10.1088/1361-6528/ab0837)

Abstract

Morphology is a critical parameter for various thin film applications, influencing properties like wetting, catalytic performance and sensing efficiency. In this work, we report on the impact of oxygen partial flow on the morphology of ceramic thin films deposited by pulsed DC reactive magnetron sputtering. The influence of O₂/Ar ratio was studied on three different model systems, namely Al₂O₃, CuO and TiO₂. The availability of oxygen during reactive sputtering is a key parameter for a versatile tailoring of thin film morphology over a broad range of nanostructures. TiO₂ thin films with high photocatalytic performance (up to 95% conversion in 7 h) were prepared, exhibiting a network of nanoscopic cracks between columnar anatase structures. In contrast, amorphous thin films without such crack networks and with high resiliency to crystallization even up to 950 °C were obtained for Al₂O₃. Finally, we report on CuO thin films with well aligned crystalline nanocolumns and outstanding gas

sensing performance for volatile organic compounds as well as hydrogen gas, showing gas responses up to 35% and fast response in the range of a few seconds.