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Effect of Si incorporation in ZrN Thin Films Deposited by Reactive Magnetron Sputtering

Eduardo Tentardini¹, Flavio Freitas¹, Daniel Fernandez¹, Lucas Felix¹, Gleyciane Souza¹, Roberto Hubler², Agenor Henz³, Fabiana Mendes⁴

¹Federal University of Sergipe / DCEM, São Cristóvão, Brazil ²Pontifícia Universidade Católica do Rio grande do Sul, Porto Alegre, Brazil ³Federal University of Rio Grande do Sul, Porto Alegre, Brazil ⁴Instituto Nacional de tecnologia, Rio de Janeiro, Brazil

etentardini@gmail.com

Nitride transition metal thin films have been used in the last decades due to properties as hardness, wear resistance and mechanical strength. Zirconium nitride (ZrN) is a typical coating used because of its tribological properties and corrosion and oxidation resistance. Even with differentiated properties, ZrN thin films have columnar microstructure, micro-cracks and pores, which are defects associated with sputtering deposition process. These discontinuities allow direct contact between the external environment and the substrate, compromising the mechanical properties and applications in high temperature or corrosive environments.

An alternative to modify ZrN thin films microstructure and morphology is the addition of a third element as silicon. The Si addition promotes the formation of a two phase microstructure, which one is crystalline (ZrN) and the other is amorphous (Si₃N₄). This characteristic has potential to change thin film morphology and macroscopic properties.

The study proposal was to deposit thin films of ZrSiN system by reactive magnetron sputtering varying the Si concentration in each coating. XRD, SEM, RBS, XPS and nanoindentation techniques were used to analyze the morphology and mechanical properties of the coatings.

Keywords

thin films
magnetron sputtering
ZrSiN
oxidation
high temperature