PO3001

Deposition and characterization of NbxAlx-1N thin films for high temperatures applications

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Niobium nitride (NbN) has been widely explored as protective coatings due properties such as high hardness, wear and corrosion resistance, among other characteristics which makes it an interesting option for applications that require good mechanical performance. Although having such good properties, the oxidation temperature of NbN is near to 700 K, which compromises its applicability in situations that require resistance when the material is exposed to high temperatures. One possibility to hinder the NbN oxidation process is the addition of a third chemical element, as aluminum, which has been successfully used in TiAlN and CrAlN thin films, demonstrating good results in mechanical properties and oxidation behavior of these coatings However, there is scarcely any work regarding NbAlN thin films, in some works it is possible to notice that aluminum concentration in NbAlN films directly affect the coating properties such as hardness, oxidation resistance and wear. However, information such as morphology and chemical bonding among Nb, Al and N is still not completely clarified in the literature, since NbN is a complex material which possesses various crystalline phases. The present work investigates the influence of aluminum concentration on NbxAlx-1N thin films deposited by reactive magnetron sputtering. Coatings were exposed to temperatures up to 1000 K and then characterized by Scanning |Electron Microscopy (SEM), Grazing Angle X-ray diffraction (GAXRD), Rutherford Backscattering Spectrometry (RBS), X-ray photoelectron spectroscopy (XPS) and nanohardness tests. The characterizations will be performed before and after oxidation tests, in order to verify possible changes in morphology, chemical bonding and mechanical properties.

Keywords
NbAlN
magnetron sputtering
thin films
oxidation