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Corrosion - erosion behavior of magnetron sputtered NbN films in aqueous slurries

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Abstract – This work concentrates on the protection provided by the NbN coating on a combined erosion–corrosion attack as a function of particles velocities and impact angles. The test were realized with impact angles of 30 °, 60 ° and 90 ° and allows varying the rotation speed of 0 to 3410 rpm with a slurry that consists of quartz particles suspended in a mixture of sulphuric acid solution and 3.5% NaCl, whit cathodic protection. Scanning Electron Microscopy was used to evaluate the erosion–corrosion mechanisms in the various conditions.

New generation PVD coatings include the niobium nitride (NbN) coatings due to its excellent properties such as high chemical inertness, excellent mechanical properties, high electrical conductivity, high melting point, and a superconducting transition temperature around 16 K. In this work we reported the results the study of corrosion and erosion effect on niobium nitride coatings deposited on AISI 304 stainless steel using unbalanced and balanced magnetron sputtering and then it were compared to the uncoated tool steel substrate. The corrosion–erosion experiments were studied in a test machine varied the different velocities and impact angles of the erodent particles. The slurry used consists of quartz particles suspended in a mixture of sulfuric acid solution and 3.5% NaCl, whit cathodic protection. The film microstructure and composition were analyzed by X-ray diffraction (XRD), cross-section scanning electron microscopy (SEM) and X-ray photoelectron spectroscopy (XPS). The results indicated that the erosion–corrosion resistance of the coated samples was found to be superior to that of the uncoated sample and the wearing mechanisms on the coating and the steel depending on the impact angle and the impact velocity of erodent particles. Possible reasons for such behavior are described in this paper.

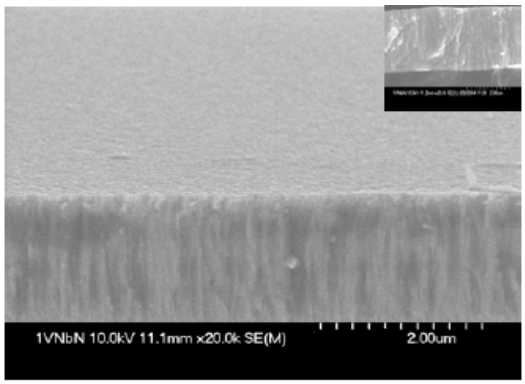

Figure 1: Cross section of the coatings by scanning electron microscopy (SEM)

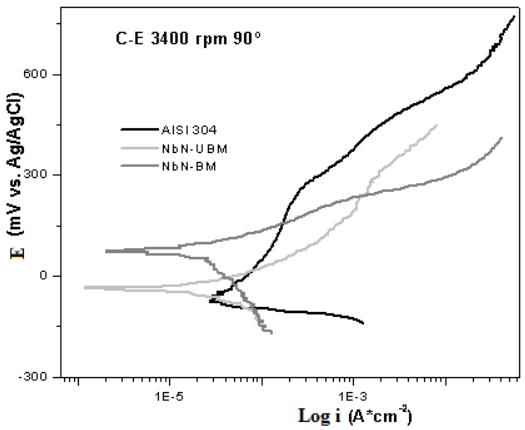

Figure 2: Polarization curves for AISI 304 and NbN-UBM and NbN-BM PVD coatings, angle of 90° and rotation velocity of particles erosive of 3400 rpm