Vacuum Metallurgy Division
Room Hall A - Session VM-MoP

Vacuum Metallurgy Division Poster Session

VM-MoP1 Studies on Corrosion, Wear and Erosion-Corrosion of Aluminum Coated Steel before and after Nitrogen Ion Implantation, *M. Ghoranneviss,* ***M. Abyar Monfared Kashani****, S. Meery, H. Parcharmi, A. Shokohi,* Islamic Azad University, Iran

Aluminum base coatings have been used many years as a protective layer on steels, but application of this coating is limited due to its poor wear and corrosion resistance. The main goal of this work is increasing corrosion and consequently erosion-corrosion resistance of these coatings. Steel samples were coated with different aluminum alloy by means of ion beam sputtering and then implanted by different dose and energy nitrogen ion beam. We studied properties of this coating before and after ion implantation by potentiodynamic polarization, pin on disk and rotating coupon tests. Optical and electron microscopes were also used. The results of these tests are discussed in the paper.

VM-MoP2 Deposition of bcc Ta and beta-Ta Films using Different Underlayers, ***L.V. Kozlovsky****, A. Antinsh,* University of Daugavpils, Latvia

The formation of crystalline phases in sputtered Ta films can be attributed to the deposition conditions as well as to the nature of the substrate. We deposited 100 nm Me / X nm Ta (Me: Mo, W, Nb, Ti, Zr, Hf, Dy, Fe, Al; X = 40,100, 200 nm) bilayers on room-temperature glass substrates in a Xe discharge at a pressure of (5 - 8) x10@super -4@ Torr using Penning discharge sputtering devices @footnote 1@. The base pressure was nearly 5x10@super -9@ Torr. 10 nm C underlayers were deposited on substrates at the same vacuum conditions before bilayers deposition. The structure of the films was investigated by X-ray diffraction (XRD). XRD profiles revealed peaks corresponding to (110), (220), (211) reflections of bcc Ta, peaks at d = (0.2665 0.2672) nm and the second orders of these reflections. The peaks were attributed to the beta-Ta phase in the films. Ta films on Nb, W, Mo, Ti, Al had bcc structure. Ta/Dy, Ta/Fe films structure was characterized as beta-Ta and Ta/Zr and Ta/Hf films consisted of a mixture of bcc Ta and beta-Ta. The Me and Ta layers had preferred orientation of close-packed planes parallel to the substrate plane (the [111], [110], [001] planes for the fcc, bcc, hcp metals correspondingly). The shortest interatomic distances (SID) in the Me are the shortest distances between the atoms in these planes. The correlation between beta-Ta formation in Ta/Me bilayers and mismatching of the SID in bcc Ta and in Me was found. Results of Ta films crystal structure investigations will be presented and discussed. @FootnoteText@ @footnote 1@ 1. L.V. Kozlovsky. Istrum. Experim. Techniq., 38, iss. 3, pt. 2, 417, (1995).

VM-MoP3 Graded TiAlN Layers Deposited by ECR Assisted Reactive Sputtering, *A. Raveh,* ***M. Weiss****,* Nuclear Research Center-Negev, Israel

Graded layers have been reported to reduce property discontinuities at the interface. TiAlN layers were deposited by plasma reactive sputtering employing dual cathode radio-frequency sputtering targets, Ti and Al, assisted by electron cyclotron resonance (ECR). The layers were deposited using various combination of parameters such as power input, bias substrate voltage and gas feed composition. The deposition process was monitored by optical emission spectroscopy (OES). The OES results indicate that microwave excitation added to radio-frequency plasma has contrasting effects on Ti and Al concentration in the gas phase, enhancing titanium and quenching aluminium species reaching to the deposited substrate. Thus, by the regulation of the ECR power and the ratio of nitrogen flow to nitrogen plus argon flow, the formation of graded layers is allowed. Hence, this approach was found appropriate for controlling and tailoring the interface between a metallic substrate and hard coating. The layers formed in this way were characterized with regard to structure, composition, and mechanical properties using X-ray diffractometer, Auger electron spectroscopy microscope, and Vickers microhardness and scratch tester (adhesion). It was observed that layers deposited at a low ECR power (@<=@100 W) yielded oriented (111) crystalline structure with good adhesion (failure load >70 N). These layers displayed a higher microhardness (~25 GPa) at bias substrate voltage (-50 VDC) than that of grounded substrate (10-15 GPa). However, layers deposited at an ECR power higher than 100W showed a random or amorphous structure with an intermediate adhesion range (failure load 30-50 N). The relationship between the processing parameters, the structure, and the properties of the layers formed will be presented and discussed.

VM-MoP4 Microwave Plasma Nitriding of Pure Iron, ***E. Camps****,* Instituto Nacional de Investigaciones Nucleares, Mexico, México*; S. Muhl, O. Alvarez-Fregoso, J. Chavez-Carvayar,* IIM, UNAM, Mexico*; O. Olea-Cardoso,* UAEM, Mexico

This paper presents the results of a study in which the performance of an electron cyclotron resonance (ECR) plasma source has been evaluated in regard to it's use for the nitriding of pure Fe. Diagnostic measurements,using optical emission spectroscopy (OES), Langmuir probes and an ion analyzer, were recorded as functions of the working pressure (2 - 8 x 10@super -4@ Torr) and for two different configurations of the external magnetic field near the substrate (compressed and divergent plasma flux). It was observed that the plasma source is capable of producing high density discharges, about 5 x 10@super 11@ cm@super -3@ and ion energies about 15 25 eV. Although the average ion energy was higher for the case of a divergent plasma flux (~ 45 eV). The most abundant radicals produced in the N/H discharges were NH, N@sub 2@ and N@sub 2@ @super +@ species. Experiments for nitriding of Fe showed the formation of distinct material structures when using different plasma conditions. Under certain conditions it was possible to form almost single phases of Fe@sub 3@N and Fe@sub 16@N@sub 2@ in the sample surface.

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