Advanced Surface Engineering
Room Hall A-C - Session SE-TuP
Poster Session

SE-TuP1 Synthesis and Elastic Properties of Polycrystalline Thin Films with Cr2AlC Structure*, J.M. Schneider,* ***Z. Sun****, R. Mertens, F. Ãœstel,* RWTH-Aachen, Germany*; R. Ahuja,* Uppsala University, Sweden

We report the synthesis and characterization of polycrystalline thin films with Cr2AlC structure by magnetron sputtering. Ab initio total energy calculations using the Projector Augmented-Wave (PAW) was used to investigate the electronic structure. Our estimated d spacing values agree well (within 3 to 6 â€°) with glancing incidence X-rax diffraction data of the as deposited films. No peaks other than the ones of Cr2AlC were observed.

SE-TuP2 Growth of PACVD c-BN Films and c-BN/Diamond Bilayers*, M.S. Wong,* National Dong Hwa University, Taiwan, ROC, Taiwan, R.O.C*; J.B. Cheng,* ***T.S. Yang****, S.S. Chu,* National Dong Hwa University, Taiwan, ROC

The synthesis of c-BN films was carried out by the reaction of BF3 and N2 in the hydrogen and argon mixture using microwave plasma-assisted chemical vapor deposition (PACVD). The effects of N2/BF3 ratios, hydrogen addition, DC substrate-bias voltage and diamond as bufferlayer on the formation of c-BN were investigated. As-grown films are characterized by FTIR, grazing-incidence XRD, and SEM. The composition of gas mixture and energy of ion bombardment are critical to the formation of c-BN phase in the BN films. Under optimal growth conditions and using nanocrystalline diamond film as bufferlayer, the growth of high c-BN content up to ~85 % c-BN was achieved.

SE-TuP3 Kinetics of Boron Nitride Thin Film Formation using Low Energy Ion Beam Assisted Deposition*,* ***W. Otaño****,* University of Puerto Rico at Cayey

Cubic boron nitride (cBN) is a superhard material, which is defined as a material with microhardness over 40 GPa, and offers the best combination of high hardness, low friction coefficient, resistance to oxidation, and resistance to chemical degradation with iron-based materials. Other applications of cBN take advantage of its high density, high thermal conductivity, good transparency in the visible and infrared portion of the spectrum, and high electrical resistivity. Cubic BN is also a wide band gap semiconductor, which can be n- and p-type doped. Several models have been proposed to describe the nucleation and growth of cBN thin films based on the observation of the necessity of energetic bombardment of the growing film for the stabilization of the cubic phase. These models include the concept of thermal spikes, the subplantation model, stress-induced stabilization, and resputtering of the BN hexagonal phase. Several authors have been able to correlate the energetic bombardment with P/a, the total momentum imparted to the growing film per arriving boron atom. In this report, the use of a high intensity, low energy ion source, incorporated to an ion beam assisted deposition system to study the kinetics of the cBN thin film nucleation at bombarding ion energies in the 50-100 eV range will be discussed. It will be shown that the control of the ion bombardment and of the incoming boron atom flux is critical for the kinetics of formation of the boron nitride films. The implications for the nucleation process of the BN cubic phase and a comparison with systems using high deposition rates will be discussed.

SE-TuP4 Mechanistic Studies of the Wet Chemical Oxidation of Hydrogen-terminated Si(100)*,* ***C.A. Shea****, K.T. Queeney,* Smith College

Wet chemical cleaning of the Si(100) surface is a critical step in wafer processing for microelectronics. Oxidation of HF-etched (hydrogen-terminated) Si(100) surfaces occurs both intentionally (via peroxide solution) and uninentionally (e.g. during rinsing steps) and can affect both the chemistry and the morphology of the underlying substrate. We have used a combination of surface infrared spectroscopy and contact angle measurement to follow both the microscopic and macroscopic evolution of the H-terminated Si(100) surface during aqueous oxidation. Ex-situ transmission IR experiments allow us to elucidate the role of solution species including dissolved oxygen and OH@super -@ on both the rate and the mechanism of oxidation by following changes in both the Si-H and Si-O regions of the infrared spectrum. Contact angle hysteresis provides a measure of surface heterogeneity during these processes; comparison with the more uniform Si(111) surface provides a benchmark for the degree of inhomogeneity inherent to the rougher H:Si(100) substrate.

SE-TuP5 Rheological Modeling of Fracture Mechanics of Hard Coatings on Soft Substrates at Hertzian Indentation*, M.V. Kireitseu,* ***L.V. Kireitseu****,* Institute of Mechanics and Machine Reliability, Belarus

The present work described rheological modeling of novel coating «chrome carbide nanoparticles – aluminum oxide – soft aluminum substrate» and «steel – viscous-elastic polymer – aluminum – aluminum oxide» at their Hertzian indentation. When the hard aluminum oxide-based coatings are brought into contact with a ceramic or a metal indenter, different stress-deformation modes can be developed between the materials. Strains and forces will depend upon the state of the surfaces, its roughness and the fundamental mechanical properties of the two solids that are both indenter and substrate. Mechanical behaviour between the coatings and another solid indenter are discussed from a theoretical consideration of the mechanical constants (elasticity, plasticity and viscosity) of the coatings and experimentally by relating loading forces and stresses to the interface resulting from the contact. Rheological models were proposed for the coatings and were confirmed by in-suit experiments using principal Hertzian theory. An experimental evidence showed good agreement between the models and mechanical behavior of the coatings. Load rating tests revealed ultimate stresses and stress-deformation modes for both the coatings and their particular layer. The models and its behavior under a few fundamental conditions of loading (triangle, pulse, sinusoidal etc.) are discussed. @FootnoteText@ none

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