2012 Technical Symposia

Call For Papers
Abstract Deadline: October 1, 2011
Manuscript Deadline: March 1, 2012

The International Conference on Metallurgical Coatings and Thin Films or ICMCTF is internationally recognized as a vibrant technical conference that integrates fundamental and applied research focused on thin film deposition, characterization, and advanced surface modification techniques. It is the premier international meeting in this field, bringing together scientists and technologists from both academia and industry, thereby merging up to date research with cutting edge applications.

The conference consistently draws more than 700 attendees each year within 32 oral technical sessions and a well-attended poster session.

ICMCTF 2012 is organized in seven concurrent technical symposia A through G and four special topical symposia, which address experimental, theoretical, and manufacturing issues associated with development of new coating materials and processes, and evolving approaches to scale-up for commercial applications.

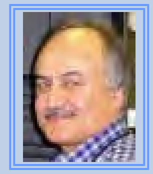
In addition to the technical program, the conference features a two-day industry exhibition, which is open to the public, showcasing the latest in equipment, materials and services used for the deposition, monitoring and characterization of coatings and thin films. Short courses and Focused Topic Sessions (FTS) will be offered throughout the conference week.

Select the links below for detailed information as to the individual Symposia and sessions. . . . .

2012 Technical Symposia:

A. Coatings for Use at High Temperature
B. Hard Coatings and Vapor Deposition Technology
C. Fundamentals and Technology of Multifunctional Thin Films
D. Coatings for Biomedical and Healthcare Applications
E. Tribology & Mechanical Behavior of Coatings and Engineered Surfaces
F. New Horizons in Coatings and Thin Films
G. Applications, Manufacturing, and Equipment

2012 Topical Symposia:
TS1. Surface Engineering for Thermal Transport, Storage and Harvesting
TS2. Advanced Characterization of Coatings and Thin Films
TS3. Energetic Materials and Micro-Structures for Nanomanufacturing
TS4. Graphene and 2D Nanostructures



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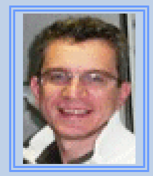

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BP-40 Effect of degree of ionization on preferred orientation and properties of TiN thin films deposited by high power impluse magnetron sputtering, ***C.Y. Chen***, *G.P. Yu*, National Tsing Hua University, Taiwan, *J.Y. Wu*, Institute of Nuclear Energy Reserach, Taiwan, *J.H. Huang (jhhuang@mx.nthu.edu.tw)*, National Tsing Hua University, Taiwan

Due to its high hardness and low electric resistivity, TiN has been widely used as protective coatings on cutting tools and as diffusion barrier in microelectronic devices. The preferred orientation of TiN thin film is one of the major parameters that may affect the film properties. Therefore, many mechanisms have been proposed to explain the evolution of the preferred orientation of TiN deposited at different conditions. Most TiN specimens in the previous studies were prepared using dc magnetron sputtering. Few studies were performed at highly ionized condition to investigate the effect of ionization on the preferred orientation and the corresponding TiN thin film properties. Recently, high power impulse magnetron sputtering (HIPIMS) has attracted considerable interests in industrial applications. By using power supplies that are able to provide the target with very high pulsing power density within several microseconds while maintain the average target power density similar to dcMS, HIPIMS can generate an ultra-dense plasma (10^{13}~10^{14} ions/cm^3) where the sputtered atoms are highly ionized (70%~100%). As a result, this highly ionized plasma can be used to bombard the substrate, deliver energy to adatoms to facilitate their migration, and even manipulate thin film preferred orientation to tailor the film properties. The purpose of this research was in an attempt to control the preferred orientation of TiN thin film using HIPIMS with different degree of ionization. In this study, by varying pulse shape, or nitrogen flow rate to control the degree of ionization of HIPIMS, TiN thin film was deposited on Si wafer. Subsequently, the microstructure, compositions, and mechanical properties of the TiN thin film were fully characterized. The preferred orientation was characterized by X-ray diffraction. The microstructure and to measure thin film thickness was observed by SEM. The composition of the film was determined by XPS and RBS. Nanoindentation and four-point probe were utilized to measure the film hardness and the electric resistivity, respectively. The residual stress of the TiN film was measured by optical laser curvature method. The results showed that the preferred orientation of thin film varied with the degree of ionization. The mechanical properties and resistivity of the thin film were also sensitive to the degree of ionization. However, since the thin film was extensively bombarded by ion under the deposition conditions, the TiN film possessed very high residual stress. The experimental results indicated that by adjusting the degree of ionization of plasma, the thin film preferred orientation and the accompanying properties can be controlled.

BP-41 Microstructures and mechanical properties of titanium carbide coating obtained by Thermo-reactive deposition process, ***X.S. Fan*** *(fxs@stu.xjtu.edu.cn), Z.G. Yang, C. Zhang*, Tsinghua University, China

Thermo-reactive deposition/diffusion (TRD) process is a method used to prepare hard, wear-resistant coatings of carbides, nitrides, or carbonitrides on steels. In this study, carbide coating was tried to deposit on T10 steels by duplex treatment. The steel substrate was immersed in a molten salt bath consisting of vanadium then in a molten salt bath consisting of titanium at 1000 ^{o}C. The obtained coatings were characterized by scanning electron microscopy (SEM), energy dispersive X-ray spectrometry (EDX) and X-ray diffraction (XRD). The results showed that the coating obtained from the duplex treatment was composed of two distinct layers. The outer layer was titanium carbide and the inner layer was vanadium carbide. The substrate /vanadium carbide coating interface and the vanadium carbide coating/ titanium carbide coating interface is distinct and without transition zone. The micro-hardness, scratch and pin-on-disk wear tests were conducted to evaluate the mechanical properties. The results showed the hardness of the duplex coating is higher than the vanadium carbide single layer. And the duplex coating exhibited excellent adhesive strength and outstanding wear resistance.

BP-42 Enhanced Glow Discharge Plasma Immersion Ion Implantation Using an Insulated Tube, ***Q.Y. Lu***, *P. Chu (paul.chu@cityu.edu.hk)*, City University of Hong Kong, Hong Kong Special Administrative Region of China, *L. H. Li*, City University of Hong Kong; Beijing University of Aeronautics and Astronautics, Beijing, China, *R. Fu*, City University of Hong Kong, Hong Kong Special Administrative Region of China

Enhanced glow discharge plasma immersion ion implantation (EGD-PIII) conducted using a small pointed hollow anode and large tube cathode has certain advantages over conventional plasma immersion ion implantation (PIII). In EGD-PIII, the plasma is produced by self glow discharge induced by the negative high voltage applied to the sample. The plasma distribution measured by Langmuir probe measurements discloses that the electron density is quite uniform in the vicinity of the negatively biased substrate. Although the impact energy and ion implantation fluence have been demonstrated to be better in EGD-PIII than those in conventional PIII, lateral non-uniformity in the ion fluence is observed during hydrogen implantation into a silicon wafer and the ion focusing effect depends on the plasma density. An insulated tube placed between the chamber and gas inlet is employed to increase the interaction path for electrons and neutrals, and theoretical and experimental studies reveal that the insulated tube can enhance ionization of plasma gases with low ionization efficiency such as hydrogen. However, the implantation current is observed to increase sharply at a certain pressure when the plasma gas consists of diatomic molecules. In this work, we experimentally investigate the implantation current characteristics in EGD-PIII. The plasma potential is measured to investigate the discharge phenomenon and X-ray photoelectron spectroscopy (XPS) is conducted to corroborate the findings.

Fundamentals and Technology of Multifunctional Thin Films: Towards Optoelectronic Device Applications
Room: Golden Ballroom - Session CP

Symposium C Poster Session

CP-1 Investigation on Physical Properties of $CuInSe_2$ Films Prepared by Pulsed Laser Deposition, ***M.H. Wen***, *J.Y. Luo, Y.T. Hsieh, C.C. Chang, C.H. Hsu, Y.R. Wu, W.H. Chao, M.K. Wu*, Institute of Physics, Academia Sinica, Nankang, Taiwan, *H.S. Koo (frankkoo@must.edu.tw)*, Ming-Hsin University of Science and Technology,Taiwan

We report the study on thin films composed of the Cu-rich $CuInSe_2$ (CISe). The films were deposited on the glass and Mo-coated substrate, respectively, by the pulsed laser deposition (PLD) method at substrate temperatures from 450℃ ~ 600℃. Both films revealed an obvious orientation (112) when the substrate temperature above 450 ℃. By applying different substrate temperatures, different grain size and crystallinity of CISe films were obtained. The films showed a p-type electrical conductivity with a high absorption coefficient of 10^4 ~ 10^5 cm^{-1} and optical energy gap of 0.92 ~ 0.97 eV.

CP-2 Electro-optical properties and damp heat stability of Al-doped ZnO thin films prepared by laser induced high current pulsed arc deposition, ***J.B. Wu*** *(wujinbao@itri.org.tw), C.Y. Chen, C.C. Shih, J.J. Chang, M.S. Leu*, Material and Chemical Research Laboratories, Industrial Technology Research Institute, Taiwan, Republic of China, *H.Y. Tseng, Y.C. Lu*, BeyondPV Co., Ltd, Taiwan

Highly transparent conductive Al-doped ZnO (AZO) thin film was deposited at 100 °C by laser induced high current pulsed arc (LIHCPA) from an Al-Zn alloy target (2 and 3 wt.% of Al doping content). The film's properties were highly correlated to the growth conditions, including O_2 partial pressure and Al doping content. The results clearly showed that when the O_2 partial pressure increased from 8×10^{-2} Pa to 3×10^{-1} Pa, the resistivity gradually increased from 4.2×10^{-4} to 1.9×10^{-3} Ω-cm and 5.2×10^{-4} to 2.3×10^{-3} Ω-cm for the 3 and 2 wt.% of Al-Zn target. Likewise, t he band gap of the AZO films calculated by UV/VIS spectrometer measurement decreased from 3.77 eV to 3.58 eV and 3.56 to 3.44 eV as well. The XRD results showed that the AZO films preferred *c*-axis orientation along the (002) plane. XPS analysis revealed that the Zn and O chemical state can be assigned to the Zn exits in the oxidized state and O occurs in two chemical state (I) O^{2-} ions on wurtzite structure of hexagonal Zn^{2+} ion array, surrounded by Zn and the (II) chemisorbed oxygen species like O^{2-}, O^- and O_2^- at the grain boundaries, respectively. The degradation and performance studies of AZO and its variants have been performed under varied temperature conditions at 85% RH. The results indicated that samples held at 37 °C and 45 °C did not show any degradation of the sheet resistance upon exposure. However, the final sheet resistance of AZO films held at 85 °C showed 2 times higher than that for as-grown films.

CP-3 Effect of Dopants and Thermal Treatment on Properties of Ga-Al-ZnO Thin Films Fabricated by Facing Targets Sputtering System, *K.H. Kim (KHKim@kyungwon.ac.kr)*, ***J.S. Hong***, *Kim*, Kyungwon University, Republic of Korea

For preparation of new material transparent electrode, we prepared the Ga and Al doped ZnO (Ga-Al-ZnO; GAZO) thin film under various conditions by using facing targets sputtering (FTS) system as function of input current and thermal treatment temperature.

The FTS system can prepare the thin film using new materials because it uses two targets. Also, the substrate is located in a plasma-free area apart from the center of plasma so it can suppress high energy particles colliding to the substrate so high quality films can be prepared.

The properties of the as-deposited GAZO thin films were then examined by 4-point prove, atomic force microscope (AFM), X-ray diffractometer