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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Additionally, a more efficient method to improve the permeability was carried out by using a non-symmetrical double-sided coating of SiO_x (150 nm) and organosilicon(100 nm)/ SiO_x (250 nm) stacked films on the PES substrate. Because the double-sided coatings is to balance the stress and obtain a flat and noncurved barrier substrate, the WVTR can be decreased down to 0.001 g/m^2/day, which is one order of magnitude lower than that of a single-sided barrier coating. Such simple and novel multilayer barrier structure is a promising candidate for the application on the encapsulation technology of the flexible optoelectronic devices.

GP-7 Surface modification using silane coupling agent for polypropylene with high gas barrier property, ***H. Tashiro***, *A. Hotta (hotta@mech.keio.ac.jp)*, Keio University, Japan

Polymer materials such as polypropylene (PP), polyethylene (PE), and polyethylene terephthalate (PET) are widely used as food packaging materials due to their lightness, low cost, and optical transparency. However, most of the polymer materials have low gas barrier property which may cause a great damage on the quality of food products. Thus the improvement of the low gas barrier property is widely desired.

Recently, thin solid coatings by diamond-like carbon (DLC) and silicon oxide (SiOx) based on plasma technology have been prominent methods. Several researches have been reported on the gas barrier properties of polymers coated with DLC, eventually improving the gas barrier properties of certain types of polymers. However, most plasma systems used for the syntheses of DLC and SiOx are operated under low pressure and, therefore, require an expensive and complicated vacuum system.

As a new thin coating method, silane coupling treatment was investigated. The silane coupling agent is a common adhesion promoter and is widely used in polymeric composites. In addition, the silane coupling agent possesses high transparency, and it can easily spread over polymer films since it is in a liquid state. Furthermore, the silane coupling treatment can solidify itself through hydrolysis, which can be an easier and faster way to produce a high gas barrier coating.

According to the results of the gas permeation test, it was found that the polymers coated with various types of silane coupling agents showed high gas barrier properties. Especially the silane coupling agents with an amino group showed a very low oxygen transmission rate which was comparable to the results of PET with high gas barrier property. Additionally, PP films remained transparent even after the coating. Such improvement in gas barrier property may be due to the formation of siloxane (–Si–O–Si–) networks through hydrolysis and condensation processes. It is also considered that the siloxane networks had a dense molecular structure similar to that of SiOx, which resulted in establishing an impermeable layer. The method could be applicable to several types of polymers including PE.

GP-8 Manufacturing of mode-conversion type microwave plasma CVD apparatus and applying for synthesis of carbon materials, ***T. Kameshima*** *(tack_kameshima@yahoo.co.jp)*, Graduate School, Chiba Institute of Technology, Japan, *H. Tanaka*, Shutech Co., Ltd., Japan, *Y. Sakamoto*, Chiba Institute of Technology, Japan

For fabrication of thin film using microwave plasma CVD, mode-conversion type microwave plasma is expected to improve the deposition area and growth rate . By converting the TE_{10} mode to the TM_{01} mode for microwave, electric field component is changed from vertical direction of the rectangular waveguide into the circumference direction of the circular waveguide . And then, uniform electric field distribution can be obtained. So, larger deposition area and higher growth rate may be perform ed. Moreover, quality of deposits is improved because of the higher microwave density . On the other hand, carbon materials such as diamond and diamond like carbon (DLC) can be obtained by using microwave plasma CVD . So, investigation was carried out on the manufacturing of mode-conversion type microwave plasma CVD apparatus and applying for synthesis of carbon materials.

Different wavelength s microwave of 2.45 GHz and 915 MHz were applied to experimental apparatus. The mode of microwave was converted by using of mode convertor. It is important to discharge plasma at higher microwave density and higher pressure to obtain higher growth rate and high qualities for diamond growth.

Diamond synthesis using the apparatus applied 2.45 GHz microwave, CH_4-H_2 mixture gas system was used as the reaction gas. The flow rate of CH_4 and H_2 were set at 1 to 10 and 100, respectively. Pressure, microwave power and reaction time were unified at 20.0 kPa, 1.5 kW, and 3h, respectively. Si wafers scratched by diamond powders were used as substrates. The deposits were characterized by a scanning electron microscopy (SEM) for surface observation, and Raman spectroscopy was used for estimation of quality of deposits.

Results of the surface observation by SEM, deposits which has clear crystalline shape were observed in all the conditions. In addition, in the estimation of quality of deposits by Raman spectroscopy, diamond peak at 1333 cm^{-1} was observed in their Raman spectra of all samples, and DLC peak at 1550 c m^{-1} was ob serv ed.

In the case of the apparatus applied 915 MHz microwave, 915 MHz microwave apparatus is tried to set up the similar configuration . The deposition area will be larger by applying 915 MHz microwave because of longer wavelength.

In conclusion, diamond was synthesized from CH_4-H_2 reaction gas system using mode-conversion type microwave plasma CVD apparatus applied 2.45 GHz microwave.

GP-9 A novel technique to suppress self sputtering of radio-frequency electrode in capacitively-coupled glow discharge, ***X.B. Tian*** *(Xiubotian@163.com), Y.H. Ma, C.Z. Gong, S.Q. Yang*, Harbin Institute of Technology, China, *P. Chu*, City University of Hong Kong

A novel technique to suppress self sputtering of radio-frequency electrode in capacitively-coupled glow discharge

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The capacitively-coupled Radio-frequency discharge (CCP) has been widely utilized in industry. The self-sputtering effect induced by self bias on the radio-frequency electrode inherently exists. This may produce the metal contamination to the generated plasmas. Although some measures including quartz covering have been taken and the sputtering effect was weakened, the self-bias does not be eliminated. In this paper we proposed a novel technique to decrease the self-bias and resultant self-sputtering effect. An external circuit was added into the radio frequency discharge circuit. The self bias on radio frequency electrode may be counteracted by external energy. Our experimental results have demonstrated that the self-bias on the electrode may effectively be eliminated. The positive and negative waveform of radio fervency current seems to be symmetric. The electrical circuit to weaken the self-bias is described and the waveform before and after the external circuit is coupled is compared and suppression effect of self sputtering is experimentally demonstrated.

GP-10 An experimental study on a large area multi-electrode discharge in the fabrication of microcrystalline thin film solar cell, ***H. Seo*** *(shseo69@kaist.ac.kr), S. Lee, Y. Chang*, Korea Advanced Institute of Science and Technology

Recently, there have been many research for higher deposition rate (DR) and good uniformity of μc-Si:H film in large-area discharge. Two factors should be the most important issues in the fabrication of the thin film solar cell. In order to solve these issues, several dicahrge conditions, including large area electrode (more than 1.1 mx1.3 m), higher pressure (more than 1 Torr), and very high-frequency RF power (more than 40 MHz), have attracted. But, in the case of large-area capacitive discharges (CCP) driven at high frequencies, the effect caused by the standing wave should be important limitation. Furthermore, the ion damage on the thin film layer by the high sheath voltage can cause the defects, which degrade the film quality.

Here, we will propose new CCP electrode concept, which consists of a series of electrodes and grounds arranged by turns, and provide the processing results. The high DR (1 nm/s), the controllable crystallinity (~70%), and the relatively good uniformity can be obtained at the high frequency of 40 MHz in the large-area discharge (280 mm x 540 mm). And, we will show the TEM images of the μc-Si:H films at the various conditions of μc-Si:H films, and discuss the crystal formation compared to the case of VHF CCP. Finally, we will discuss the issues in expanding the multi-electrode to the 8G class large-area plasma processing (2.2 mx2.4 m) and in improving the process efficiency.

GP-11 Advanced PVD coatings in a combination with a new intermetallic substrate for hobs - A major step forward in productivity, ***P. Immich*** *(pimmich@lmt-fette.com), U. Kretzschmann, U. Schunk, R. Fischer*, LMT Fette Werkzeugtechnik, Germany

The ever increasing demand for higher productivity in manufacturing gears requires advanced hard coatings and new substrate materials. Up to now in this field of gear manufacturing two different substrate materials are availed for single-piece hobs: powder metallurgy high-speed steel (PM-HSS) and cemented carbide. Today PM-HSS has a market share around 70% offering limited cutting speeds for wet and dry conditions on labile machine conditions. On the other hand cemented carbide offers from the technical point of view strong performance related features like high cutting speeds up to 400 m/s on stable machine conditions. .