Advanced Surface Engineering
Room: Hall D - Session SE-ThP

Advanced Surface Engineering Poster Session

SE-ThP1 Investigation of Polarization Conversion Effect in Obliquely Deposited SiOx and As_2S_3 Films, ***M.V. Sopinskyy***, *I.Z. Indutnyy, V.I. Mynko, P.E. Shepeliavyi*, V Lashkaryov Institute of Semiconductor Physics, NASU, Ukraine

Polarization conversion effect have been studied to find out anisotropy in the obliquely deposited SiOx and As2S3 films. The films were obtained by thermal evaporation and oblique deposition of SiO and As2S3 onto polished Si and silica substrates. During deposition the substrates were oriented at the angles β between the normal to the substrate surface and the direction to the evaporator. The polarization conversion is an interesting phenomenon which causes the fraction of p(s)-polarized light incident on an anisotropic thin film be reflected as s(p)-polarized light.[1] The optical anisotropy of the obliquely deposited SiOx and As2S3 films was detected using the data on the polarization conversion of the electric vector caused by the passage of polarized light through the film. For this purpose the light beam with the electric vector linearly polarized in the direction perpendicular to the plane of incidence (the s-polarized light beam) was projected on the samples and the ellipsometer table was rotated around the normal to the sample surface (rotation angle α = 0°-360°). The angular rotation of analyzer (θ) was measured by means of the ellipsometer with a sensitivity of 0.02°. Normally deposited SiOx and As2S3 films don't show any in-plane anisotropy. For As2S3 films deposited at β=75° and SiOx films deposited at β=60° there are observed θ(α) dependencies with the period of 180° (symmetrical, or assymetrical). In this case, principal axes of high-frequency dielectric constant tensor εik for those films are mutual perpendicular, and two of them lie in the plane parallel to film substrate (one is parallel, and another perpendicular to the direction of the projection of the vapor-beam's direction on the substrate surface). The third principal axis of εik is perpendicular to the substrate surface or is slightly inclined to the perpendicular. For SiOx films deposited at β=75° θ(α)-dependencies have 360°period value. In this case the third principal axis of εik is inclined toward the substrate surface. It directly shows that obliquely inclined columns are formed in such films. Thus, investigation of polarization conversion effect is simple, nondestructive and useful method to distinguish the type of in-plane and out-of-plane structural anisotropy of obliquely deposited films.

[1]R. M. A. Azzam and N. M. Bashara, (1986). Ellipsometry and Polarized Light (Amsterdam: North-Holland).

SE-ThP2 Influence of Oblique Incidence on the Properties of Ion Beam Sputtered Chromium and SmCo Films, *B. Ramamoorthy*, Indian Institute of Science, *A. Raju*, Honeywell Technology Solutions Lab, ***S. Mohan***, Indian Institute of Science

Ion Beam Sputter Deposition (IBSD) technique with its unique characteristics like lower operating pressure, well collimated mono energetic beam, independent control over the energy and flux is considered superior over the conventional sputtering techniques in processing thin films with tailored properties. In addition to the above features, the energy of the sputtered species is also relatively higher in IBSD. The spatial and angular distribution of the sputtered species here, also could be controlled by controlling the incident angle of ions over the target. This ability to fine control the energy of the sputtered species has been well utlized in depositing high density optical films. This energy imparting kinetics also forms the basis for the commonly used ion assisted deposition. Though the energy advantages have been well utilized, the angular distribution has not been explored much. In this work, we explore the advantages of angular distribution of the sputtered species, in modifying the properties of Cr and SmCo films. In the IBSD system used in the present study , ions were incident over the targets at an angle of 45^o degrees and substrates were placed at angles 10^o, 20^o and 30^o measured from the target normal. The substrates were heated to 600^o C. Chromium and SmCo films were deposited sequentially without breaking the vaccum. The deposited films were studied for their composition, structure and their magnetic properties. The structural studies indicate different structural orientations with different substrate position. Self shadowing of the condensed atoms, higher mobility on the plane of the substrate during oblique incidence have been found to be responsible for the structural variations which otherwise would not have been possible with other process parameter combinations. The change in the structure has also been found to alter the magnetic properties of the films. The films deposited at normal incidence show a coercivity of 4kOe whereas the films deposited at an angle of 30^o show a coercivity of 6kOe. The increase in the coercivity has been attributed to the preferential orientation of SmCo films caused due to the oblique incidence. The results obtained will be discussed in detail from the context of oblique deposition.

SE-ThP3 Characterizations of Polarization-Discriminatory Inverters Fabricated by Glancing Angle Deposition, ***Y.J. Park***, *K.M.A. Sobahan, C.K. Hwangbo*, Inha University, Republic of Korea

Glancing angle deposition (GLAD) is a thin-film fabrication technique with controlled microstructures and provides advantages over conventional evaporation techniques. Based on physical vapor deposition, it employs an oblique-angle-deposition and substrate motion to allow nanometer-scale control of the structure in engineered thin-film materials. The films deposited in this technique show the optical anisotropy originating from the microstructures and the porosity of the films increase due to shadow effects. These controls can be utilized to engineer thin films for specific applications such as three-dimensional photonic crystals, gradient index optical filters, broadband antireflection coatings, and linear polarizer, etc. In this study, we investigate the optical and structural properties of linear and circular polarization-discriminatory inverters. Circular polarization-discriminatory handedness inverter is realized as a combination of half-wave plate and Bragg reflector and that of linear polarization inverter is realized as a combination of quarter-wave plate, Bragg reflector and quarter-wave plate. The zigzag microstructures of the quarter-wave plates as well as the half-wave plates and the helical structure of the Bragg reflector are fabricated by electron beam evaporation using GLAD technique and Ti@O@sub 2 material is used in this purpose. The physical thicknesses of the half and quarter-wave plates are calculated using their anisotropy. The polarization-discriminatory inverters show that the incident linear and circular polarized light becomes opposite linear and circular polarized lights with Bragg effect at output. The structural and surface morphology of this device are also investigated using scanning electron microscope (SEM).

SE-ThP4 Influence of Substrate Temperature on Reactive-sputtered Tin-nitride Thin Films Prepared by Glancing Angle Deposition, ***H. Tsuda***, *H. Takeuchi, Y. Inoue, O. Takai*, Nagoya University, Japan

1. Introduction Properties of tin-nitrogen compounds have not been recognized in detail. Tin-nitride was reported to exhibit a spinel structure (Sn_3N_4) at low temperature, while tin-nitride films deposited at high temperature showed a zinc blende (SnN) structure. As one of the properties of tin nitride, we found that amorphous tin-nitride (a-SnN) films prepared by reactive ion plating show an erectrochromic (EC) phenomenon, which is a reversible color change of materials induced by applying a burst of electrical charge. We have reported that the EC phenomenon occurs due to the change of surface adsorption at indium nitride film, so that the color-change efficiency is strongly influenced by surface area. Moreover, it is influenced by crystallinity. Therefore, both the expansion of surface area and the improvement of crystallinity are important. In this study, we aim to investigate the properties of reactive-sputtered tin-nitride thin film prepared by glancing angle deposition (GLAD). 2. Experimental procedure The tin-nitride films were prepared by using a conventional rf magnetron sputtering system. After evacuation of a deposition chamber under 1×10^{-3} Pa, high-purity N_2 gas was introduced into the chamber up to 1 Pa. Then rf power (13.56MHz, 75W) was applied to a metallic tin target of 4N purity. The angle of a substrate holder against the sputtered tin flux was set at 0° and 85°. In-plane rotation condition of the substrate holder was controlled by a motor. We used both Si (100) single crystal wafers and glass plates as substrates. The substrate temperature was controlled by a halogen spot heater. Crystallinity and microstructure of the films was characterized by an X-ray diffractometer (XRD) and a scanning electron microscope (SEM). 3. Results In the case of non-heating substrates, we confirmed that both the samples deposited at 0° (sample A) and at 85° (sample B) have the spinel (Sn_3N_4) crystal phase. The cross-sectional surfaces of the sample A showed a dense columnar structure. EC characterization revealed that the sample A shows no EC phenomenon. On the other hand, the microstructure of the sample B is quite similar to the microvillus structure of small intestine, which consists of isolated nanocolumns. The sample B showed small EC phenomenon, which may due to the surface area much expanded than that of the sample A.

SE-ThP5 Electrochromic Response of InN Thin Films with Microstructures Controlled by Glancing-angle Deposition, ***H. Ishikawa***, *H. Takeuchi, Y. Inoue, O. Takai*, Nagoya University, Japan

1. Introduction Electrochromic (EC) materials change their colors reversibly by applying a burst of electrical charge. Indium nitride (InN) thin films also show EC phenomenon by applying electric potential in a solution. The mechanism of the EC phenomenon in InN is quite unique. We have found that the EC of InN is induced by alternation of surface adsorbates, which

means that InN is suitable for high-response EC devices. We have improved the EC properties of InN films by introducing a microvillus-like isolated nanocolumnar structure prepared by glancing-angle deposition (GLAD) in order to expand the effective surface area. However, the microvillus-like structure includes so deep gaps that the EC response property is degraded. In this study, we deposit InN films which have large effective surface area with low-height columnar structure, and their EC response property is investigated. 2. Experimental procedure InN films were deposited on ITO-coated glass plates by using a reactive ion plating system. After evacuation of a deposition chamber, pure N_2 gas was fed into the chamber at a constant gas flow of 19.0 sccm. The total pressure was controlled from 1.0 to 7.0 Pa. In order to activate N_2 plasma, a 13.56 MHz RF power of 150 W was applied to a RF antenna in the chamber. The crucible for In was resistively-heated to evaporate In metal shots (6N) in the N_2 plasma. The substrate holder was rotated during deposition at the angle of 0° or 85° with respect to the vapor fluxes. The crystallinity of the deposited films was investigated by using an X-ray diffractometer (XRD). We investigated the EC properties of the films by using both a UV-Vis spectrophotometer and an EC response measuring unit which consist of a laser diode (650 nm) and a Si photodiode. 3. Results From the XRD profiles, we confirmed that any film deposited in this study has a wurtzite crystal structure. The films deposited without GLAD technique at the total pressure of 1.0 Pa (sample A) and 2.0 Pa (sample B) have a vertical columnar structure with the columnar radius and porosity dependent on the pressure. The EC response of the sample B is faster than that of the sample A. The film deposited with GLAD configuration at the substrate angle of 85° (sample C) has much higher porosity than the samples A and B. Therefore the EC amplitude of the sample C is improved, while the EC response of the sample C was almost same as that of the sample A.

SE-ThP6 Hard Transparent Conducting Nb-doped Titania Films by Reactive Co-Sputtering, ***K.H. Hung***, *H.C. Hsing, W.C. Hsu, M.S. Wong*, National Dong Hwa University, Taiwan

The outstanding properties of titania have made them useful for many applications including photocatalysis, gas sensors, dielectric thin-film capacitors and solar cells. However, researchers have not paid much attention to their transport properties and mechanical behaviors. We have produced a series of niobium-doped titania films by reactive co-sputtering titanium and niobium targets and by subsequent annealing the films in a hydrogen environment. The composition of the films was modulated by changing the niobium target power; consequently, niobium content of the films changed from 0 to 4.2 atomic percent. The characterization studies show that the annealed films are polycrystalline with anatase phase without accompanying other crystalline oxide phases. The results also demonstrate that the films possess high visible-light transparency as well as enhanced hardness and conductivity. For instance, the doped titania film of 2.8 at% Nb deposited at a substrate temperature of 350 °C and annealed at 600°C exhibits an average transmittance of 70% in visible light region and a high hardness up to 11.4 GPa. Moreover, the Hall measurements of the film reveal n-type semiconducting behavior for this film with a reduced resistivity of 9.2E-4 ohm-cm, a carrier density of 6.61E21 cm^{-3} and a mobility of 1.0 $cm^2v^{-1}s^{-1}$.

SE-ThP7 Effect of Water Pulsed Plasma on Electrode Surface, ***N. Apetroaei***, *N. Saito, O. Takai*, Nagoya University, Japan

The aim of this paper is to contribute to a better understanding of the mechanisms, which conducted to the electrode surface modifications using the water plasma, and to correlate these experimental results with the results which we obtained from diagnosis of the plasma. The water pulsed plasma is non-equilibrium highly collisional plasma produced at rather high pressure by high voltage pulse applied to a special system of electrodes. Different electrode materials, shapes and configuration have pronounced effect on liquid discharge. In our case were used to form the electrodes, wire and rod of copper, tungsten, tantalum, molybdenum, nickel and stainless steel (SUS) with different diameter from 1mm up to 3mm for tip to tip electrode configuration and sheet of Cu and SUS for plan to plan and tip to plan electrode configuration. The high voltage power supply (4 kV) generates bipolar pulses in the range of 2 – 10μs and frequency in the range of 1 - 30 kHz. Modification of surface properties of a metallic electrode has been analyzed by contact angle measurement, scanning electron microscope (SEM) and X-ray photoelectron spectroscopy (XPS). Water plasma changes the electrode surface structure. There are few things which conduct to these changes. One is strong local heating and formation of hot spots at the electrode surface. Temperatures above the boiling point of the electrode material can de necessary depending on the work function of the metal. Another is discharge physical sputtering caused by the collision of energetic electrons or other heavy particles with electrode surface. Another is the chemical reaction between water plasma and electrode surface. Water plasma generates very active species such as: chemical aggressive atoms and radicals, charged particles-electron and ions, excited atoms and molecules. After solution plasma we observed that the proprieties (surface tension, adhesion work, roughness, oxidization) of electrode surface have changed, comparing to a new one unused to water plasma. Surface wettability is improved from contact angle measurements and SEM images show an increase of surface roughness.

SE-ThP8 A Comparative Study on the Mechanical Properties and Thermal Stability of Cr-Zr-N and CrSi-Zr-N Coatings Synthesized by Closed Field Unbalanced Magnetron Sputtering, ***G.S. Kim***, *Y.S. Kim, S.M. Kim, S.Y. Lee, B.Y. Lee*, Korea Aerospace University

Recently, the synthesis of Cr-Zr-N coatings by adding an heterogeneous atom, Zr into CrN film was successfully made using a closed field unbalanced magnetron sputtering and these Cr-Zr-N coatings are reported to have not only much improved mechanical properties, but also a very low surface roughness with increasing Zr content. Especially, the average friction coefficient against Al_2O_3 counterpart ball of the $Cr_{1-x}Zr_xN$ (X=0.34) coating was measured to be approximately 0.17 at room temperature and this value is approximately 3.5 times lower than that of CrN film (approximately 0.6). However, investigations on the high temperature characteristics of the Cr-Zr-N coatings revealed their mechanical properties are severely deteriorated at 500 ℃ due to the surface oxidation and the decrease of hardness by means of the residual stress relaxation. In this work, to improve the high temperature mechanical properties of the Cr-Zr-N films, the CrSi-Zr-N coatings were synthesized from CrSi(Si=10 and 20 at.%) and Zr targets by a closed field unbalanced magnetron sputtering and their chemical composition, crystal structure, morphology and mechanical properties were characterized by glow discharge optical emission spectroscopy (GDOES), X-ray diffraction (XRD), scanning electron microscopy (SEM), atomic force microscopy (AFM) and nanoindenter. Also, the thermal stability of the CrSi-Zr-N coatings was evaluated by annealing the thin films at temperatures between 300 and 900 ℃ for 30min in air. The experimental results showed the CrSi-Zr-N coatings exhibit higher thermal stability and mechanical properties compared to those of Cr-Zr-N coating with increasing Si content. Detailed experimental results included wear test at 500 ℃ will be presented.

SE-ThP9 A Comparative Study on the Thermal Stability of CrN, CrSiN and CrSiN/AlN Multilayer Coatings, ***S.M. Kim***, *G.S. Kim, S.Y. Lee, B.Y. Lee*, Korea Aerospace University

In this work, CrN, CrSiN and CrSiN/AlN multilayer coatings were synthesized from Cr, Al and CrSi (Si= 10 at. %) targets using a closed-field unbalanced magnetron sputtering system (CFUBMS). The coatings have been characterized by glow discharge optical emission spectroscopy (GDOES), X-ray diffractometry (XRD), transmission electron microscopy (TEM), X-ray photoelectron spectroscopy (XPS) and nano-indentation. The maximum hardness of CrSiN/AlN multilayer coating with the bilayer period (@lamda@) of 3 nm was approximately 32 GPa, whereas CrN and CrSiN coatings exhibited the maximum hardness of 22 and 27 GPa, respectively. Thermal stability of CrN, CrSiN and CrSiN/AlN multilayer coatings was investigated with annealing treatment for 30 min in air in the temperature range of 600 to 800 °C. The XRD patterns showed that CrN and CrSiN coatings were severely oxidized at 700 °C. However, in the case of CrSiN/AlN multilayer coating, no detectable oxides were observed even at 800 °C. After annealing at 800 °C, the hardness of the CrSiN/AlN multilayer coating exhibited approximately as high as 29 GPa compared to the CrN and CrSiN coatings, which showed only 8 and 18 GPa, respectively. These results revealed that the thermal stability of the CrSiN/AlN multilayer coatings were much superior to that of the CrN and CrSiN coatings at elevated temperatures because the AlN films in the CrSiN/AlN multilayer coatings retard the oxygen diffusion into the coatings. The detailed experimental results will be presented.

SE-ThP10 Investigation of Photocatalytic Activity of TiO_2/WO_3 Bilayered Thin Films with Various Amounts of Exposed WO_3 Surface, *S. Biswas, M.F. Hossain, M. Shahjahan,* ***K. Takahashi***, *T. Takahashi*, University of Toyama, Japan, *A. Fujishima*, Kanagawa Academy of Science and Technology, Japan

TiO_2 is the most widely used photocatalyst for effective decomposition of organic compounds in air and water. However, its technological application is limited by the need for an ultraviolet (UV) excitation source. One of the most promising methods to extend the light-absorbing property of TiO_2 and to enhance its photocatalytic efficiency is to couple TiO_2 with narrow-bandgap semiconductors, which act as a sensitizer. Tungsten oxide (WO_3) with band-gap 2.8 eV, is a promising candidate to be used as under-layer for TiO_2 photocatalysts. However, WO_3 should have some amount of uncovered surface so that it can act as a reducing agent. In this study, WO_3 films were deposited on glass substrates, using facing target dc reactive sputtering technique and the upper TiO_2 thin films were also deposited with the same technique using different masks to leave various amounts of WO_3-exposed surfaces: 0%, 30% and 80%. The crystallographic properties,

surface structures and optical properties of WO_3 films were investigated in detail. The X-ray diffraction patterns show triclinic and anatase crystal structure for the WO_3 films and TiO_2 films, respectively. The optical and surface morphological properties of both WO_3 and TiO_2 layers have been studied using UV-visible spectrometer, field emission scanning electron microscope (FESEM) and atomic force microscope (AFM). The photocatalytic activity was measured by the rate of photodecomposition of methanol in UV and visible light irradiation, evaluated by Fourier transform infrared spectrometer (FTIR). The results show that with the variation of WO_3 exposed area, photocatalytic activity of WO_3/ TiO_2 system varies significantly. It is revealed that, with the increase of WO_3-exposed surface photocatalytic activity increases initially, but it decreases with the further increase. The result has been tried to be explained on the basis of methanol-photodecomposition mechanism and the amount of relative exposed surface of WO_3 and TiO_2.

SE-ThP11 Structural, Optical and Photocatalytic Study of Spray Pyrolysis-Deposited ZnO: Al Thin Films, ***M. Shahjahan***, University of Toyama, Japan, *K.R. Khan,* Rajshahi University, Bangladesh, *M.F. Hossain, S. Biswas,* University of Toyama, Japan, *T. Takahashi*, Toyama University, Japan

ZnO is a semiconductor with unique properties such as transparency in the visible and high infrared reflectivity, acoustic characteristics, high electrochemical stability and excellent electronic properties. ZnO has received much attention because of its promising applications of optoelectronic nano-devices, piezoelectric nano-generators, dye-sensitized solar cells, bio-devices and photocatalysts for degradation and complete elimination of environmental pollutants. Porous ZnO films with large surface area have great applications in photovoltaic and photocatalytic devices. Moreover Al-doped ZnO (ZnO:Al) shows lower band gap. In the present study an effort has been made to fabricate ZnO:Al on glass substrate using low-cost spray pyrolysis method with higher surface area. Structural, optical, electrical and surface morphological studies of the fabricated films have been performed. Photocatalytical activity of the fabricated films has been studied. The crystal structure of annealed samples was investigated by X-ray diffraction (XRD). XRD patterns show crystalline nature of the spray deposited ZnO and Al-doped ZnO thin films with three main peaks, (100), (002) and (101) planes. ZnO crystal has wurtzite structure and the calculated lattice constants a and c are 3.242 Å and 5.209 Å respectively and the grain sizes are in the range of 16.75 to 52.19 nm. The surface morphology of the films was observed by a scanning electron microscope. It has been observed that the film surfaces are varied with the deposition conditions and doping concentrations. The spectral absorption coefficient of the ZnO and ZnO:Al films was determined using the spectral data of transmittance and reflectance in the UV-visible wavelength range. The direct and gap energies for ZnO and ZnO:Al were determined and the values obtained are 3.2 eV and 2.88 eV, respectively. Photocatalytic activity of ZnO:Al thin films have been evaluated with various pollutant under UV-visible irradiation.

SE-ThP12 Strain-Rate Sensitivity of Nanocrystalline Nanolaminates, ***H.S.T. Ahmed***, *A.F. Jankowski*, Texas Tech University

The strain-rate sensitivity of strength is one of the key parameters to understand the deformation mode of nanocrystalline materials. It is widely reported that many nanocrystalline materials strength harden with increasing strain rate. Often, an increasing strain rate exponent is observed as the grain size decreases from the micro- to the nano- scale. This trend suggests that the mode of mechanical deformation is transitioning from within the grains to becoming a grain boundary effect. For nanocrystalline nanolaminates, another dimensional feature becomes significant. The layer pair spacing must now be accounted for in addition to the grain size. This additional nanoscale feature can become especially important when its size decreases below that associated with conventional dislocation-based strengthening mechanisms. We now investigate the hardness of transition metal nanolaminates for which both grain size and laminate dimensions are less than 10 nm. New data is acquired through the technique of nanoscratch testing. We report an increasing rate sensitivity of strength, as measured by the plastic flow associated with hardness, when dimensional features are further reduced to below 10 nm.

SE-ThP13 Effect of Deposition Temperature on Microvillus-structured InGaN Films Deposited by Glancing-angle Reactive Evaporation, *H. Takaba,* ***H. Takeuchi***, *Y. Inoue, O. Takai*, Nagoya University, Japan

1. Introduction Electrochromic (EC) materials have a unique property of reversible color change with a burst of electrical charge. Much attention has been paid to the EC materials for application to “smart windows”, which control electrically the light and heat through the windows. We have investigated the EC properties of indium nitride (InN). The EC of InN is based on so-called Burstein-Moss shift induced by alternation of surface adsorbates. We have improved the EC properties of InN both by doping Ga to shift the color-change wavelength region and by introducing a biomimetic structural design in nano order to increase the EC amplitude. In this study, we deposit microvillus-structured InGaN films at some substrate temperatures and investigate the effect of deposition temperature on crystallinity, biomimetic structure and EC properties. 2. Experimental procedure The Ga-doped indium nitride ($In_{1-x}Ga_xN$, $0 \le x \le 1$) films were deposited in a vacuum evaporation system assisted with an active nitrogen source. Indium and gallium were deposited simultaneously from respective crucibles through a downstream of the nitrogen plasma generated from the active nitrogen source at the conditions of the nitrogen pressure of 0.04 Pa and the RF power of 300 W. The substrate holder was rotated at the speed of 10 rpm with the angle against the metal fluxes at 85° in order to synthesize the biomimetic microvillus-like nanostructures, and heated by lamp heater from behind. Crystallinity, microstructure and EC properties of the $In_{1-x}Ga_xN$ films were characterized by XRD, FE-SEM and UV-VIS spectrophotometry, respectively. 3. Result From XRD analysis, we confirmed that the In@1-x@Ga@x@N films prepared at high substrate temperature had higher crystallinity than at non-heated temperature. EC measurements showed that the EC amplitude of InGaN increased with the crystallinity improvement at high Ga composition. However, at low Ga composition, that of prepared at 150°C was larger than at 200°C because the effective surface area decreased due to microstructure evolution.

SE-ThP14 Surface of Pb1-xSnxTe Films by Pulsed Laser Deposition, *M. González-Alcudia,* CICATA-IPN, México, *M. Meléndez-Lira,* CINVESTAV-IPN, México, *O. Calzadilla-Amaya,* Universidad Habana, Cuba, ***M. Zapata-Torres***, CICATA-IPN, México

The interest in pulsed deposition was tirggered by the observation that PLD is superior to thermal deposition in inducing layer by layer growth of heteroepitaxial metal films. We present the design of a pulsed laser deposition modified system (PLD-M) which is suitable for materials engineering work. Various concepts in growth structure of Pb1-xSnxTe films for PLD-M have been pursued to optimize its performance. A macroscopic description of growth insatabilitiesn of Pb1-xSnxTe films is usually presented in the framework of only 2D nucleation, determined by the supersaturation, limited interlayer mass transport results in nucleation on top of 2D islands before completion of a film layer. Extensive measurements (AFM, XRD and SEM) were carried out to test the micro structural characteristics of the Pb1-xSnxTe films. In the case of PLD-M, a typical value for the deposition rate within one pulse is of the order of 10 mm/s and the radius of droplets formed during single pulse irradiation is the r KH ≈ 0.05 μm. These new approaches offer new possibilities for further development of the field in close connection with surface science and materials science.

SE-ThP15 Enhancement of Hydrophilicity and Photo Catalytic Activities of Nanocrystalline TiO_2 Thin Film Doped with Tungsten, *R.R. Pandey, K.K. Saini,* National Physical Laboratory, India, ***M. Dhayal***, University of Washington, *C. Chander Kant, S.C. Jain*, National Physical Laboratory, India

In this study tungsten ion doped nanocrystalline TiO2 thin films has been fabricated using dip-coating technique on glass substrates. Surface structure and chemistry of the films was characterized using X-ray diffraction, transmission / scanning electron microscopy, UV-visible spectroscopy, X-ray photoelectron spectroscopy and FTIR. The tungsten ions doping in the film have significant influence on the morphology and surface chemistry. These nanocrystalline films have shown improved activity on the oxidation of organic pollutants possibly due to enhanced surface area with more active site in presence of tungsten.

SE-ThP16 High Power Pulse Plasma Generator for Material Processing, *R. Chistyakov,* Zond Inc., ***B. Abraham***, Zpulser LLC

High Power pulse Plasma Generator for Material Processing. Roman Chistyakov1,2, Bassam Abraham1,2 Zond, Inc1/Zpulser2, LLC, 137A/137 B High Street, Mansfield, MA 02048, A new high power pulse plasma generator was developed. This plasma generator can generate negative arbitrary voltage pulse shapes in the range 200 – 1500 microsecond in wide range of output power. By applying these pulses to the sputtering magnetron arbitrary pulse power magnetron discharge can be produce. The typical arbitrary voltage pulse shape for magnetron sputtering consists from two stages. The first stage is a low power discharge and the second stage is a high power discharge. The presence of two power stages in one pulse reduces the probability to have arc and increases ionization of sputtered material. High power pulse plasma generator is a switching power supply. User friendly software enables full control of the switching device. This plasma generator was successfully used for different sputtering applications including reactive and non reactive processes. The principals of building arbitrary voltage pulse shapes will be discussed. The examples of different voltage pulse shapes for different sputtering conditions will be presented.

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