Fundamentals and Technology of Multifunctional Materials and Devices
Room Grand Exhibit Hall - Session CP
Symposium C Poster Session

CP-1 Reversible Photo-Induced Deformation of Amorphous Carbon Nitride Films and their Potential Application to Light Driven Actuators, *T Harata, M Aono, K Ishii, N Kitazawa,* ***Yoshihisa Watanabe,*** National Defense Academy, Japan

Amorphous carbon nitride (a-CNx) films are known as useful coating materials. Recently, we first observed reversible photo-induced deformation of hydrogen-free a-CNx films under visible light illumination [1]. This phenomenon suggests that the a-CNx films have potential applications to light driven actuators. In this paper, we report fundamental studies for applying a-CNx films to light driven actuators.

The hydrogen free a-CNx films were prepared by reactive radio frequency magnetron sputtering using a graphite target and pure nitrogen gas. The substrate temperature during deposition was kept at 573 K. The substrates used were silicon single crystal plate with the thickness of about 0.5 mm. The self-standing a-CNx film with the thickness of about 1 μm was obtained by peeling the deposited film from the Si substrate in pure water. The diaphragm with the diameter of 4.6 mm was prepared by sandwiching the self-standing a-CNx film between metal rings and the movement of the diaphragm was measured using a laser vibrometer under white light illumination.

The photomechanical response was measured when the light illumination is turned on and off with the interval of 15 s, and the results show that the diaphragm reiterates stably and the typical amount of the displacement was about 120 μm. These results suggest that the a-CNx films have potential for light-driven actuators with good stability.

The authors would like to thank Keyence Corporation for helping the laser vibrometer measurements. This research is supported by JSPS KAKENHI Grant Number 26790054.

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CP-2 Mechanisms of Grain Growth Enhancement in Sintered-CZTS Nanoparticle Thin Films, ***Edgar Palmes,*** *S Exarhos, R Xu, L Mangolini,* University of California, Riverside, USA

An innovative and scalable synthesis approach to the formation of Cu_2ZnSnS_4 (CZTS) nanocrystals has been developed using aerosol spray pyrolysis. This quaternary-phase material is a potential replacement for currently commercialized semiconductors such as CdTe and CIGS that are currently used in photovoltaic devices. However, sustainability and environmental issues threaten long-term viability of these materials. Based upon earth abundant constituents and low chemical toxicity, CZTS, with a reported band gap of ~1.5 eV, appears to be a superior alternative to these other materials. Additional research and development is necessary to increase the efficiency of CZTS-based cells from the current record (12.6% by Wang *et al.*[1]) to the >18% necessary to be considered commercially viable. Our work stresses the controllable, cost-effective, and reproducible synthesis of high-quality CZTS nanoparticles and sintered thin films. Specifically, our goal is to demonstrate increased crystal grain growth in CZTS needed for higher efficiency rates of CZTS-based cells. Incorporating alkali dopants, specifically sodium, has been successful in enhancing grain growth in CZTS thin films [2]. However, current methods of sodium doping primarily rely on imprecise external diffusive sources such as sodium halides, sodium hydroxides, or the use of soda lime glass. Based off of work by Tiong *et al*., who experimented with controllably doping sodium into CZTS films via dipping in sodium halide solutions [3], we show further results of attempting to control sodium composition by coating the surface of CZTS nanoparticles with a controlled amount of sodium hydroxide – our group has also shown that the introduction of an oxide to the surface of CZTS nanoparticles can also enhance uniform grain growth. The coated particles are then dispersed into a CZTS nanoparticle ink, coated onto a sodium-free substrate, mechanically compacted, and annealed at 600 ºC for 1 hour in a low pressure sulfur atmosphere. The resulting material is extensively characterized to determine morphology, composition, and structure.

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CP-3 Development of Dual Coating Process for Effective Combination of Sand Mold Process and 3D Printing Technique, ***Hyun-Hee Choi,*** *H Park, E Tumenbayar, G Cho, E Kim, Y Jung,* Changwon National University, Republic of Korea*; J Zhang,* Purdue University, USA

In a conventional sand casting, the mold is prepared by mixing silica-based starting powders with resin-based organic binders. Therefore, the mold collapses easily by the degradation of the organic binders during casting. Nevertheless, the sand mold has been widely used in the manufacturing industry due to its simplicity and low production cost. In this work, a dual coating process is developed to combine the sand mold process and 3D printing technique. Two types of polyvinyl alcohol (PVA) with the different boiling points were applied. In the dual coating process, the starting powder was coated with PVA with the lower boiling point, and then re-coated with PVA with the higher boiling point, followed by 3D printing process. The sample was heat-treated at 250C for 4h in order to burn out the PVA with the lower boiling point. The heat-treated sample was dipped into an inorganic binder slurry, composed of tetraethyl orthosilicate (TEOS) and sodium methoxide (NaOMe), which are the silica (SiO_2) and sodium oxide (Na_2O) precursors, respectively. After dried at 80C for 1h, the final heat-treatment was conducted at 1000C for 1h for organic-inorganic conversion. The green and firing strengths were much enhanced compared with the conventional converting process, which are due to the increased amount of inorganic precursor causing a sol-gel reaction for the green strength, and the glass phase converted by the inorganic precursor filled in the spaces of the evaporated PVA and coated on the surfaces of particles for the firing strength. Relationship between the coating process and the strength was extensively discussed, including applicability of dual coating process into 3D printing technique.

CP-4 New Converting Process for Fabrication of Ceramic Core through 3D Printing Technique, ***Hye-Yeong Park,*** *H Choi, E Tumenbayar, G Cho, E Kim, Y Jung,* Changwon National University, Republic of Korea*; J Zhang,* Purdue University, USA

In a conventional converting process, the core green body prepared with starting powder and organic binder, generally called as resin, is directly dipped in the inorganic binder precursor. However, the process reduces the content of inorganic precursor by the organic binder filled on the interface between the starting particles, resulting in reduced mechanical properties of the core. In this work, a new converting process combined with 3D printing technique has been developed to fabricate core samples. The new process allows to provide sufficient amount of inorganic binder on the particle surface and at the interface between particles. Two types of poly vinyl alcohol (PVA), which have the same molecular structure with a large difference in the boiling point, were used as an organic binder. Green body with the two kinds of PVA was 3D printed, and then heat-treated at 250℃ to evaporate the PVA with the lower boiling point. The heat-treated core samples were dipped into the inorganic precursor, and dried and heat-treated at 1000℃ for organic-inorganic converting process. T his series of new processes could enhance the fracture strength of core owing to the increase of the inorganic precursor infiltrated in spaces/sites of the evaporated PVA. In the new converting process, the formability of core sample was induced through the organic compounds remained and inorganic binder penetrated between particles and/or coated on the particle surfaces, and the firing strength is attributed from the glass phase generated by the inorganic precursor. Therefore, the formability and firing strength of core prepared through the new process were favorably improved. This means it would be readily applied to the production of core using 3D printing techniques, without further shrinkage in heat treatment at high temperature.

CP-7 Bias-photo Stability of Hafnium-aluminum-zinc-oxide Thin Film Transistors, ***Ju-Hee Park,*** *S Lee, H Jun, J Park,* Hanyang University, Republic of Korea

Amorphous oxide semiconductors (AOSs) have demonstrated their advantages as applications for flat panel displays (FPDs) due to their electrical performance, transparency in visible light, and room-temperature deposition. Oxygen vacancies in AOS materials play the role of generating carriers and thus provide a conducting path and at the same time, they are components that may deteriorate the stability of the AOS-based thin film

transistors (AOS-TFTs) by forming defects. To improve the stability of AOS-TFTS, the oxygen vacancies have to be reduced. Recently, a number of studies regarding the incorporation of materials with a low standard electrode potential (SEP) into AOS materials, such as yttrium (Y), hafnium (Hf), and zirconium (Zr), have been reported. Particularly, Hf has a lower SEP (- 1.56 eV) than that of Zn (- 0.76 eV) and HfO_2 has a larger bandgap (5.8 eV) than that of ZnO (3.3 eV). Thus, the addition of Hf to the indium-zinc-oxide (IZO) system is expected to control the electrical characteristics of the films and improve the stability of TFTs by controlling oxygen vacancies. Recently, K. Ghaffarzadeh et. al. introduced TFTs using hafnium-indium-zinc-oxide (HIZO) as an active layer. They showed that the stability of the HIZO TFTs due to bias-stress and photo-stress was improved as a result of the reduced interface charge trapping. However, when Hf is used in TFTs, it may decrease the channel mobility due to the reduction of carrier concentration, leading to the significant decrease of the on-current. Furthermore, the In element used in the HIZO TFTs is an earth-rare material. For this reason, some studies without using In in AOS-TFTs have recently been reported to aim at maintaining high channel mobility.

In this study, we have fabricated a TFT using the channel layer with a hafnium-aluminum-zinc-oxide (HAZO) thin film in order to enhance the device performance and stability. The HAZO films were deposited on SiO_2/Si substrates at room-temperature via co-sputtering where separate targets of hafnium-oxide and aluminum-zinc-oxide were used. The structural, optical, and electrical characteristics of HAZO films were evaluated using various methods, such as X-ray diffraction (XRD), atomic force microscopy (AFM), X-ray photoelectron spectroscopy (XPS), UV/visible spectrophotometer, Hall measurements, and I-V characteristics analyzer. The electrical characteristics of the HAZO-TFTs as well as the stability of the devices due to bias-photo stress were also analyzed as functions of Hf and Al contents.

CP-11 Electrical and Magnetic Properties of (Al, Co) co-doped ZnO Films Deposited by RF Magnetron Sputtering, ***Yu-Wei Lin***, *S Chen,* Ming Chi University of Technology, Taiwan*; H Sun,* Ocean University of China, China*; C Wang,* Ming Chi University of Technology, Taiwan*; C Wen, T Chuang,* National Taiwan University, Taiwan*; X Wang,* Ocean University of China, China

In this work, (Al, Co)-ZnO films were co-sputtered on glass substrate through radio frequency sputtering at 100 °C. The film's structure, electrical and magnetic properties as a function of Al doping content is investigated. The results indicate that (Al, Co)-ZnO films crystallinity can be suppressed by Co doping or (Co, Al) co-doping. With the substitution of Zn by Al , the film's conductivity improves. All the films present ferromagnetic behavior at room temperature. With increasing Al doping amount, the film's saturation magnetization expresses a carrier-concentration dependent behavior. Three different regions can be defined, where BMP model and carrier-mediated exchange mechanisms play a role in the various regions.

CP-13 Development of Low Temperature TiO_2 Mesoporous Scaffold for Perovskite Solar Cells, ***Gwomei Wu,*** Chang Gung University, Taiwan

Perovskite solar cells have become attractive candidates for modern thin-film photovoltaic devices due to their high performance and promising cost-competitiveness. The prevailing fabrication methods involve spin-coated materials and vapor-deposited thin films. They are much less expensive than the high-vacuum deposition equipments used in the semiconductor industry. The organic-inorganic hybrid solar cells combine a mesoporous scaffold, a perovskite light absorber and an organic hole transporter. However, it requires a high annealing temperature up to 500℃ to sinter the mesoporous layer. Thus, it is interesting to develop lower temperature processing schemes by different chemical sources for the solution spin-coating techniques. The different film-forming characteristics should be investigated. In this report, TiO2 nanoparticles could be coated from a binder-free colloid to form the mesoporous scaffold with low processing temperature. The different chemical formulations were prepared for solution-processed spin-coatings on glass substrates. The low temperature processed multi-layered photovoltaic structures were examined and presented in this study. This work was supported in part by the Ministry of Science and Technology under research grants MOST105-2221-E182-059-MY3 and NERPD2E0481.

CP-15 Atmospheric Plasma Deposition of Oxide Semiconductors, ***Blake Emad,*** University of Dayton, USA*; J Ferguson,* Materials and Manufacturing Directorate, Air Force Research Laboratory, USA*; C Muratore,* University of Dayton, USA

Atomic layer deposition (ALD) is unsurpassed as a technique for application of uniform, conformal, and continuous thin films on a broad range of useful substrates, especially those with ultra-high aspect ratios or complex morphologies, as the precursors are in the gas phase and easily fill all spaces with characteristic lengths greater than 0.5 nm. Three principal shortcomings of conventional ALD include: (1) reliance on vacuum pumps to reduce the pressure in the growth chamber and pull gas in resulting in long individual half cycle times—many of which are required to apply films of appreciable thickness (~50 nm), (2) contamination from precursor gas reactions that only proceed to a fraction of total completion, and (3) challenges (high temperature, high vacuum, containment within vacuum reaction vessel, etc.) associated with integration into additive manufacturing which could lead to custom components with integrated antennas and other device functionality especially in components employing conformal nature of the ALD coatings. Novel atmospheric plasma-based processes for synthesis of semiconducting oxides such as ZnO, GaO, IGZO (indium gallium zinc oxide) are presented. Techniques include a rapid ALD process where gas is cycled thru microvolumes adjacent to the substrate, rather than filing and vacating an entire processing chamber with the necessary series of vapor phase precursors to increase the effective growth rate of materials substantially. The precursors are selected so gaseous byproducts after ALD film formation are safe for exposure to open air. Results from optical spectroscopy of the atmospheric plasma processes is presented to demonstrate relationships between process characteristics and the structure and composition of the materials. For example, the degree of ZnO crystallization will play a critical role in its transport properties, and will therefore be thoroughly characterized using Raman spectroscopy and X-ray diffraction. The composition will first be measured with XPS, which has a resolution of approximately 1 atomic percent. Once contaminants are below this level, property measurements will be most useful for understanding atomistic-scale defects such as impurity atoms or vacancies. Nanocrystalline ZnO grown via pulsed laser deposition is a semiconductor material reported to possess high charge mobility (>100 $cm^2\ V^{-1}\ s^{-1}$), an extremely high on/off ratio (>10^{12}), and be useful for high frequency (500 MHz) device operation. These parameters set the baseline for our comparisons of atmospheric pressure plasma enhanced ALD, where the aim is to match or surpass these values of mobility, on/off ratio, and maximum operating frequency.

CP-18 Structural and Magnetic Properties of Perovskite $SrMnO_3$ Thin Films Grown by Molecular Beam Epitaxy, ***Jiawei Bai,*** East China Normal University, China

In this work, we report the structural and magnetic properties of the ~30 nm epitaxial (001) $SrMnO_3$ thin films grown on (001) $SrTiO_3$ substrate by molecular beam epitaxy (MBE). In situ reflection high energy electron diffraction (RHEED) intensity oscillation is used to precisely adjust the stoichiometry by tuning the shuttered time during the growth. The structural properties of the $SrMnO_3$ thin film is characterized by atomic force microscopy (AFM), X-ray diffraction (XRD) and transmission electron microscopy (TEM). The surface of the thin film with obvious steps is observed to be atomically flat. The epitaxial single crystal $SrMnO_3$ thin film which is grown along the direction of (001) STO substrate is typical cubic crystal structure. The film is confirmed to be four-fold symmetric along the <001> azimuth by X-ray diffraction ϕ scan. The XRD reciprocal space map indicates that the $SrMnO_3$ thin film is fully strained in the present thickness. Due to the tension strain, the $SrMnO_3$ film exhibits ferromagnetic behavior while the bulk $SrMnO_3$ is antiferromagnetic at the same low temperature.

CP-19 Yb-doped Zinc-Tin-Oxide Thin Film and its Application to Solar Cell, ***Youngsang Park,*** *W Kim,* Yeungnam University, Republic of Korea*; G Ferblantier, A Slaoui, A Dinia,* CNRS-Université de Strasbourg, France*; H Jung, S Alhammadi, S Kwon,* Yeungnam University, Republic of Korea

The use of rare earth elements with semiconductor materials has attracted a lot of interest due to its unique properties. In this paper, we investigated ytterbium(Yb)-doped zinc tin oxide (Yb:ZTO) thin film characteristics and its application to a potential down-converter of Cu(InGa)Se2 (CIGS) thin-film solar cells. Yb:ZTO thin films were deposited by reactive sputtering of Zn and Sn metal with an oxygen flow. A few pieces of Yb were embeded in Zn metal target and thus Yb elements were supplied during Zn sputtering process. The relatively composition of Zn and Sn was controlled by changing the sputtering power(10-70W) of Sn with the fixed sputtering power for Zn(70W). Also, the substrate temperature varied from room

temperature to 400 degC. It was confirmed that smaller amount of Sn with lower sputtering power led to more incorporation of Yb into ZTO. The X-ray photoelectron spectroscopy analysis confirmed that incorporation of Yb in ZTO, and photoluminescence measurement demonstrated Yb emission. The glazing incidence X-ray diffraction showed the shift of ZTO peaks induced by the difference in composition of Zn and Sn. Finally, CIGS solar cells with a Yb:ZTO layer have been fabricated. The results suggested that cells with the highest Yb PL emission showed the highest short circuit current density and cell efficiency.

CP-20 Mo-patterning on Graphene-coated Glass Substrate for a Bifacial Cu(InGa)Se2 Thin Film Solar Cell, ***Dohyun Park***, *W Kim,* Yeungnam University, Republic of Korea

The Molybdenum (Mo) has been used as a back-contact electrode for high-performance chalcopyrite Cu(InGa)Se2 (CIGS)-based thin film solar cells, which were recently reported to have the world-record cell efficiency of 22.7 % (ZSW, 2016). The substrate-type typical CIGS cell structure is glass/Mo/CIGS/CdS/ZnO. In this paper, to investigate the feasibility of CIGS cell for the application to bifacial solar cells, Mo layer has been patterned and a few layers of transparent conducting graphene were inserted to glass/Mo interface yielding glass/graphene/Mo(patterned) substrate. The graphene sheets grown on Cu foil by chemical vapor deposition were transferred to glass substrates by a simple wet-based graphene transfer process. Then, Mo was deposited onto glass/graphene by DC sputtering. The diverse design of Mo patterning for light transparency was achieved by using custom-designed masks during Mo deposition. It was confirmed that glass/graphene/Mo thin films showed lower sheet resistance than glass/Mo samples, and the sheet resistance was monotonically decreased with the number of graphene layers inserted. The resulting CIGS device results will be also discussed.

CP-21 Enhanced Stability of Plasmonic Metal-dielectric Thin Films by CVD Grown Graphene Transfer, *T Del Rosso, Q Zaman, E Cardona Romani, F Lazaro Freire Jr., O Pandoli, R Queiroz Aucélio,* ***Marco Cremona***, Pontifícia Universidade Católica do Rio de Janeiro, Brazil

The major problem to practical application of plasmonic devices is the chemically instability of the metal-dielectric interfaces which easily oxidize and degrade influencing the performances of the thin film plasmonic substrates [1]. Here we use angle interrogation scheme of Surface Plasmon Resonance spectroscopy to study the stability of plasmonic devices constituted by metal-dielectric thin films covered with graphene grown by CVD on copper foil [2]. The gold (Au) and silver (Ag) thin films deposited on glass slides functionalized with (3-ercaptopropyl) trimethoxysilane were monitored by AFM measurements up to 24 hours, in order to observe the morphological changes of the metal surfaces during the interaction with atmosphere.

Taking advantage of the high impermeability property of graphene to gases and liquids [3], we demonstrate that a graphene on metals substrates can be used to prevent it from chemical reactions and degradation of the adhesion of the metal deposition over the glass substrates. Raman spectroscopy has been used to verify the existence and quality of graphene after transfer process over gold and silver thin films.

The stability measurements where performed in atmosphere, and are based on the monitoring of SPR angle and full width half maximum (FWHM) during time.

Our results demonstrate that graphene protected gold (Au) and silver (Ag) depositions exhibit greater stability as compared to unprotected samples (exposed to air), similar to the one associated to samples protected by typical OLEDs encapsulation technique [4]. We observed a shift in the SPR angle of about 0.005^0 for Ag /graphene and Au/graphene samples after 4 hours of observation. Such a change is comparable to the zero angle determination and limits the time interval useful for the characterization of thin films in air. Similar results were obtained for graphene covered dielectric loaded waveguides (DLWGs).

The presented stability enhancement is very important both for the graphene optical characterization [5] as well as to the use of graphene in biosensing application [6].

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CP-23 Optical Characterization and Structural of ZnO Thin Film Prepared by Reactive Electron Beam Evaporation with Ion-Assisted Deposition from Metal Zinc, ***Hung-Pin Chen***, *W Cho,* Instrument Technology Research Center, National Applied Research Laboratories, Taiwan*; C Lee,* National Central University, Taiwan*; Y Lin,* National Tsing Hua University, Taiwan*; C Hsiao,* Instrument Technology Research Center, National Applied Research Laboratories, Taiwan

Zinc oxide thin films were fabricated by reactive electron beam evaporation with ion assisted deposition using metal zinc as a starting material. The transmittance spectra were measured by a UV/VIS/NIR spectrometer and the optical constants of the Zinc oxide films were calculated from the transmittance spectra using envelope method. The refractive indices were close to bulk value of 2 and the extinction coefficients were lower than $1x10^{-3}$ in the visible light ranges when the substrate temperatures exceeded 200°C. After annealing at 600°C for 2 hours in air, the extinction coefficients of Zinc oxide films prepared at room temperature increased as the annealing temperature increased, especially in short wavelength region. The ZnO films prepared at high temperatures exceeding 200°C were polycrystalline and had a preferred orientation of (100).

CP-24 Opto-electrical Properties of Few-layer $ReSe_2$ FETS for Phototransistors, ***DongJin Lee***, *M Yoo, N Kim, G Cho, P Ko,* Chosun University, Republic of Korea

The two-dimensional (2D) materials, including graphene, h-BN, layered transition metal–chalcogenides (TMC) and layered transition metal-dichalcogenides (TMDCs), are the next generation of the opto-electronic devices. Ultra-thin devices based on the 2D materials still under development, and many of the 2D materials remained almost unexplored field. Recently, there have been reports on photodetectors based on multilayered 2D materials such as GaSe, $MoSe_2$, WSe_2 et al. In this research, we fabricated field-effect transistor (FET) based on few–layered $ReSe_2$ on substrate (Ti / p–Si / SiO_2). The electrodes (Ti) deposited by electron-bean (EB) evaporation at room temperature on silicon substrates (doped p+, conductivity: 0.003 – 0.007 Ω cm) covered with 300 nm of thermally oxidized silicon dioxide (SiO_2). The thickness of the $ReSe_2$ flake was measured by atomic force microscopy (AFM) using a Pico plus 5500 AFM (Agilent Technologies, USA). The electrical characterization was carried out using Semiconductor Parameter Analyzer 4155-A (Hewlett Packard, USA). The layered $ReSe_2$ phototransistors were high values, underscoring that $ReSe_2$ is a promising 2D material for phototransistor applications. Acknowledgement: This work was supported by the Korea Institute of Energy Technology Evaluation and Planning(KETEP) and the Ministry of Trade, Industry & Energy(MOTIE) of the Republic of Korea (No. 20164010201020).

CP-28 UV Photosensitivity in Metal-Oxide-Semiconductor Structures based on SiO_x Films containing Si Nanoparticles, *M Curiel,* ***Oscar Perez***, *N Nedev,* Universidad Autónoma de Baja California, Mexico*; D Nesheva,* Institute of Solid State Physics, Mexico*; B Valdez,* Universidad Autónoma de Baja California, Mexico*; E Manolov,* Institute of Solid State Physics, Mexico*; A Arias, D Mateos,* Universidad Autónoma de Baja California, Mexico*; O Contreras,* Universidad Nacional Autonoma de Mexico, Mexico*; V Dzhurkov,* Institute of Solid State Physics, Mexico*; R Nedev,* Universidad Politecnica de Baja California, Mexico*; J Paz,* Universidad Autónoma de Baja California, Mexico

Metal-Oxide-Semiconductor (MOS) structures using SiO_x films as gate insulators are promising for application in different types of optoelectronic devices. In this work we present results for the effect of UV light on the electrical characteristics of MOS structures containing crystalline or amorphous Si nanoparticles in the gate insulator.

SiO_x films with thickness of ~50 nm and various compositions, x varies between 1.15-1.5, were deposited by thermal evaporation in vacuum on n-type crystalline Si. After the deposition the samples were annealed at temperatures in the 250 - 1000 °C range for 30, 60 and 120 min. High temperature annealing at T ≥ 700 °C leads to formation of amorphous and/or crystalline Si nanoparticles in SiO_x layers. The formation of nanocrystals in the samples annealed at 1000 °C was verified by Transmission Electron Microscopy (TEM) and X-ray Photoelectron Spectroscopy (XPS). High resolution TEM images revealed that the nanocrystal size depends on the composition and the annealing time; for example, samples with x = 1.15 and 1.3 annealed at 1000 °C for 60 min exhibit nanocrystals with diameters of approximately 4 and 6 nm,

respectively. The XPS results showed that the annealing at 1000 ^{o}C leads to complete phase separation and formation of Si in SiO_2.

Lateral currents between two metal contacts on the top of the Si/SiO_x structure were measured in dark and under visible and UV light illumination. The dark and visible light I-V characteristics coincide, while the UV light leads to an increase of the current through the structure. The UV effect is more pronounced with the increase of the annealing temperature. The observed effect may be explained assuming UV light assisted transport between neighbor nanocrystals of electrons injected from the crystalline silicon wafer.

The obtained results indicate that the studied SiO_x layers have a potential for application in UV sensors.

CP-29 Photoresponse and Electrical Properties for Photodiodes from Graphene Oxide (GO)*, Asmaa Hendi,* King Abdulaziz University, Saudi Arabia

The nanocomposites of zinc oxide/graphene oxide (ZnO-GO) were synthesized to fabricate the photodiodes. The ZnO-GO/p-Si and ZnO-GO/n-Si diodes were prepared for various GO contents. The electrical characteristics of the ZnO-GO/p-Si and ZnO-GO/n-Si diodes were analyzed under dark and light illuminations. The photocurrent of ZnO-GO/p-Si and ZnO-GO/n-Si diodes increases with increasing GO content.

The ZnO-GO/p-Si diode having 0.03 M ratio of GO:ZnO exhibited the highest photoresponsivity with 0.5 A/W under 100 mW/cm2. It is evaluated that ZnO-GO composites can be used in fabrication of high photo sensitivity diodes.

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