

P-11-11

Compact Electro-Magnetically Operated Microfluidic System for Detection of sub-200 nm Magnetic Labels for Biosensing without External Pumps
T. Takamura¹, Y. Morimoto¹ and A. Sandhu^{1,2}, ¹ Tokyo Tech and ² Toyohashi Univ. of Tech. (Japan)
 We demonstrated a novel biosensing protocol based on mon-itoring the electrostatic manipulation and magnetic capture of 2.8 micrometer diameter superparamagnetic columnar beads used as a probe by the 130-nm-diameter target beads in pumpless liquid microchannels.

P-11-12

Monodisperse silver nanoparticles of controlled size for biomedical applications
A. P. Z. Stevenson¹, D. B. Bea², S. A. Contera¹, A. I. Cerbeto³ and S. Trigueros¹, ¹ Univ. of Oxford and ² National Center for Scientific Research (UK)
 We present the characterization of monodisperse silver, silver-functionalized and silver-alloy nanoparticles of controlled size synthesized via a novel one-step optimization of the citrate-reduction method.

P-11-13

Fabrication of various metallic nanogap electrodes using molecular ruler technique
T. Nishino^{1,2}, R. Negishi¹, H. Tanaka¹, T. Ogawa¹ and K. Ishibashi^{1,2}, ¹RIKEN, ²Chiba Univ. and ³Osaka Univ. (Japan)
 In addition to conventional nanogap electrodes, Au-Au and Pt-Pt, we demonstrated the fabrications of Al-Al, Nb-Nb, Co-Co, and asymmetric Nb-Co nanogap electrodes using molecular ruler technique the methods of which were improved. We show these methods and single electron transport properties of nanogap applying device.

P-11-14

Study of electronic structure of catalyst at Triple Phase Boundary in the cathode catalyst layer of PEMFCs by using computational chemistry method
D. Kim, H. Kobayashi, R. Nagumo, R. Miura, A. Suzuki, H. Tsuboi, N. Hatakeyama, A. Endou, H. Takaba, M. Kubo and A. Miyamoto, Tohoku Univ. (Japan)
 It is necessary to design high-efficient catalyst for implementation of polymer electrolyte fuel cells expected as a sustainable energy technology. It is important to study about the Triple Phase Boundary of catalyst layer and estimate the effect of interface on catalyst properties. In this study, we constructed the TPB model and analyzed the catalyst properties by using computational chemistry method.

Area 12: Spintronic Materials and Devices
(6 Papers)

P-12-1

Power-Aware Bit-Serial Binary Content-Addressable Memory Using Magnetic-Tunnel-Junction-Based Fine-Grained Power-Gating Scheme
S. Matsunaga, M. Natsui, H. Ohno and T. Hanyu, Tohoku Univ. (Japan)
 Ultra-low-standby-power bit-serial binary content-addressable memory (CAM) is proposed by using a nonvolatile MTJ-based fine-grained power-gating scheme. Since a single MTJ device is used as not only a storage element, but also a logic-operation element, 1T-1R CAM cell is implemented with simplicity of bit-cell level fine-grained power gating.

P-12-2

Fan-out Value in a Current-Field Driven Spin Transistor
K. Konishi¹, T. Nozaki¹, H. Kubota², A. Fukushima², S. Yuasa², M. Shiratshi¹ and Y. Suzuki¹, ¹Osaka Univ. and ²AIST (Japan)
 We proposed novel type of spin transistor, which is driven by current induced magnetic field. We obtained fan-out of 1.2 in this device with an assisting ac magnetic field.

P-12-3

Operational Conditions of Proposed Spin-Photon Memory
V. Zayets, H. Saito, S. Yuasa and K. Ando, AIST (Japan)
 High-speed non-volatile optical memory was proposed. It was proved that the recording speed of the memory can reach 2.2 TBit/sec. The low-resistivity contact between Fe nanomagnet and n-GaAs was successfully fabricated.

P-12-4

HCP-disordered CoPt electrode and exchange control layer for MgO based perpendicular magnetic tunnel junctions
W. Lim, S. C. Oh, J. H. Jeong, W. J. Kim, Y. H. Kim, H. J. Shin, J. E. Lee, S. Choi and C. Chung, Samsung Electronics Co., Ltd. (Korea)
 This letter presents a study of the perpendicular magnetic tunnel junction consisting of HCP-disordered CoPt electrode and non-magnetic exchange control layer (NM ECL). The insertion of NM ECL such as Ti, Mg, Ru, or Al improved the texture of CoFeB/MgO as well as enhanced the perpendicular magnetization anisotropy of CoPt/CoFeB.

P-12-5

Co Doping Enhanced Giant Magnetocaloric Effect In Mn_{1-x}Co_xAs Films Epitaxial On GaAs
P. Xu, S. Nie, K. Meng, S. Wang, L. Chen and J. Zhao, State Key Laboratory for Superlattices and Microstructures, Institute of Semiconductors, Chinese Academy of Sciences (China)
 We found that the Co-doped MnAs films grown on GaAs exhibit enhanced magnetocaloric effect around room temperature with transition temperature tunable by varying Co content, which may be applied in construction of layered magnetic regenerator refrigerators with drastically enhanced refrigerating power.

P-12-6

Magnetic properties of quaternary magnetic semiconductor (Cd,Mn,Cr)Te grown by MBE
K. Ishikawa and S. Kuroda, Univ. of Tsukuba (Japan)
 The magnetic properties of a quaternary DMS compound (Cd,Mn,Cr)Te were investigated. Thin films of Cd_{1-y}Mn_yCr_zTe with a fixed Mn content $x \sim 0.2$ and varied Cr contents in the range of $y = 0 - 0.07$ were epitaxially grown on a GaAs (001) substrate by MBE. In the magnetization measurements, a ferromagnetic behavior, such as hysteretic loops in the $M-H$ curves, as well as superparamagnetic features such as the blocking phenomenon in the $M-T$ curves, were observed in Cd_{1-y}Mn_yCr_zTe containing Cr contents less than 1%. The paramagnetic Curie temperature Θ_p changes its sign from negative to positive with the incorporation of Cr. These results suggest that the interaction between Mn spins becomes ferromagnetic due to the presence of a small amount of Cr.

Area 13: Application of Nanotubes, Nanowires, and Graphene
(13 Papers)

P-13-1

Operation Mechanism of Single-Wall Carbon Nanotube Network FET Studied by Scanning Gate Microscopy
N. Aoki, T. Yahagi, K. Maeda and Y. Ochiai, Chiba Univ. (Japan)
 SWNT network FET has been observed by a high resolution SGM. The SGM responses are obtained only at some specific junctions of SWNTs in the channel region. Such junctions would play an important role for the FET operation.

P-13-2

Simple Fabrication Technique for an Array of Field-effect Transistors Using High-quality as-grown Single-walled Carbon Nanotubes from Dip-coated Catalyst by Substrate Surface Modification
S. Aikawa^{1,2}, R. Xiang¹, E. Einarsson¹, S. Chiashi¹, J. Shiomi¹, E. Nishikawa² and S. Maruyama¹, ¹Univ. of Tokyo and ²Tokyo Univ. of Sci. (Japan)
 We selectively coated catalyst at the edge of pre-formed electrode by using self-assembled monolayer. An array of field-effect transistor having an as-grown single-walled carbon nanotube from dip-coated catalyst was fabricated and evaluated the properties.

P-13-3

Electrical Performance Improvement of Carbon Nanotube Network Transistors by Direct Microwave Treatment
J. Y. Han¹, U. J. Kim² and W. Park¹, ¹Hanyang Univ. and ²Samsung Advanced. Inst. of Tech. (Korea)
 This is about the I-V improvement of carbon nanotube network transistor using microwave treatment. Through this method, we dramatically increased on-off ratio of carbon nanotube transistor.

P-13-4

DFT Study on the Adsorption and Dissociation of Hydrogen Peroxide on Fe-filled Single-walled Carbon Nanotubes
J. Moreno^{1,2}, M. David², T. Roman¹, M. Sakaue¹ and H. Kasai¹, ¹Osaka Univ. and ²De La Salle Univ. (Japan)
 The adsorption possibilities for hydrogen peroxide on Fe-filled single-walled carbon nanotubes were investigated through density functional theory calculations. Results indicated molecular adsorption followed by dissociative chemisorption where hydrogen peroxide dissociated into hydroxyl radicals.

P-13-5

Investigation of UV Polymerized Fullerene Nano Whisker by ESR and FET Characteristics
T. Doi¹, K. Koyama¹, N. Aoki¹, J. P. Bird² and Y. Ochiai¹, ¹Chiba Univ. and ²Univ. at Buffalo (Japan)
 We have studied on UV polymerized FNW-FET which remain to perform in air. The results of electron transport qualitatively correspond with ESR results which FNW polymer is closer to metallic.

P-13-6

Dependency of Young's modulus on diameter in Crystalline C₇₀ Nanotubes
T. Tokumine¹, K. Miyazawa¹ and T. Kizuka¹, ¹Univ. of Tsukuba and ²National Institute for Material Science (Japan)
 We performed bending tests of individual C70 NTs by in situ TEM. From the measurements of the force-flexure relationships of the C70 NTs, the Young's modulus was estimated to be 61-110 GPa.

P-13-7

Epitaxial Graphene Field Effect Transistors on SiC substrate with Polymer Gate Dielectric
M. H. Jung, H. Handa, R. Takahashi, H. Fukidome and M. Suemitsu, Tohoku Univ. (Japan)
 We investigated the electrical characteristics of the graphene FET with a polymer gate dielectric on SiC substrate. The graphene FET shows negative Vdirac shift and a carrier mobility of 580 cm²/Vs.

P-13-8

Study on the graphene transfer process from graphitized SiC substrates
S. K. Lim¹, C. H. Cho¹, S. Y. Lee¹, H. J. Hwang¹, C. G. Kang¹, Y. G. Lee¹, J. Ahn² and B. H. Lee¹, ¹Gwangju Inst. of Sci. and Tech. and ²Hanyang Univ. (Korea)
 Graphene has attracted a great deal of attention due to excellent electrical properties and unique physical characteristics. However, the physical and chemical exfoliation of graphite can produce only a tiny piece of graphene. Thus, the processes to fabricate a large area, high quality, single layer graphene have been studied intensively.

P-13-10

Ellipsoidal Band Structure Effects on Maximum Ballistic Current in Silicon Nanowires
N. Mori^{1,3}, H. Minari^{1,3}, S. Uno^{2,3} and J. Hattori^{2,3}, ¹Osaka Univ., ²Nagoya Univ. and ³CREST-JST (Japan)
 An isotropic effective-mass approximation is often used for calculating the subband levels in a silicon nanowire (SiNW) with circular cross-section. In the present study, we investigate the validity and limitation of the isotropic approximations by comparing the maximum ballistic current densities in SiNWs.

P-13-12

Co-existence of Random Telegraph Noise and Single-Hole-Tunneling State in Gate-All-Around PMOS Silicon Nanowire Field-Effect-Transistors
B. H. Hong¹, S. J. Lee¹, S. W. Hwang¹, Y. Y. Lee², D. Ahn², K. H. Cho³, K. H. Yeo³, D. W. Kim³, G. Y. Jin¹ and D. Park³, ¹Korea Univ., ²Univ. of Seoul and ³Samsung Electronics Co., Ltd. (Korea)
 we report the co-existence of RTN and single hole tunneling (SHT) state in a PMOS gate-all-around (GAA) silicon nanowire field effect transistors (SNWFETs). We successfully identify dual SHT states which are switching between themselves by single hole trapping of a hole trap state.

P-13-13

Performance Comparisons of Schottky Barrier Transistors Using Si-, Ge- and Ge-Si Core-Shell Nanowires as Channels
J. Pu, L. Sun and R. Han, Peking Univ. (China)
 The characteristics of Si-, Ge- and Ge-Si core-shell nanowire Schottky barrier transistors are simulated. For core-shell devices, most holes tunnel at the source near the heterojunction and transport in the Ge core region, and the drain current is relatively insensitive to barrier heights of source/drain contact.

P-13-15

Enhanced Efficiency of ZnO Nanowires Based Dye-Sensitized Solar Cells with Heterosensitizer
P. H. Wang¹, S. J. Wang¹, K. M. Uang², T. M. Chen², P. R. Wang¹, T. C. Wang¹ and R. M. Ko¹, ¹National Cheng Kung Univ. and ²Wufeng Inst. of Tech. (Taiwan)
 In this work, to increase PCE, we report a tandem structure with two different sensitizer dyes (heterosensitizer) as well as ZnO-NWs by a simple hydrothermal growth method for DSSCs.

P-13-17

Synthesis of Co-Doped Fullerene Nanowhiskers and Cobalt-Encapsulated Carbon Nanocapsules
D. Matsuura¹, K. Miyazawa² and T. Kizuka¹, ¹Univ. of Tsukuba and ²National Institute for Material Science (Japan)
 It was found that (1) Co-doped FNWs can be synthesized by the liquid-liquid interfacial precipitation method, and (2) Co- and Co₂C-encapsulated CNCs can be synthesized by heating of Co-doped FNWs in a vacuum.

Area 14: Photovoltaics & Power Semiconductor Devices
(12 Papers)

P-14-1

Lateral High-Voltage 4H-SiC MOSFETs
W. S. Lee¹, C. W. Lin¹, M. S. Yang¹, C. F. Huang¹, J. Gong² and Z. Feng³, ¹National Tsing Hua Univ., ²TongHai Univ. and ³University of South Carolina (Taiwan)
 The characteristics of lateral high-voltage 4H-SiC MOSFETs built on the Si-face of a 4H-SiC semi-insulating substrate are reported. DIBL effect in these devices is also investigated.

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P-14-2

First Principles Calculations on CSL Grain Boundary Impurities in Multicrystalline Silicon

A. Sivitha, N. S. Venkataramanan, R. Sahara, H. Mizuseki and Y. Kawazoe, Tohoku Univ. (Japan)
We have carried out DFT studies on the Sigma 5(210) and Sigma 9 (221) CSL GB of multicrystalline silicon. Energy calculation shows substitution site is the preferred for the transition metals in the GB region of Sigma 5 whereas, in the Sigma 9 GB plane except chromium other metal favors segregation at both the sites.

P-14-4

Material Research on High Quality Passivation Layers with Controlled Fixed Charge for Crystalline Silicon Solar Cells

T. Tachibana¹, T. Sameshima, Y. Iwashita^{1,2}, Y. Kiyota, T. Chikyow², H. Yoshida^{3,4}, K. Arafune, S. Satoh^{3,4} and A. Ogura^{1,4}, ¹Meiji Univ., ²NIMS, ³Univ. of Hyogo and ⁴CREST-JST (Japan)
In this study, we evaluated and controlled positive and negative fixed charge in the binary composition oxide thin layers fabricated by the combinatorial pulsed laser deposition

P-14-5

a-Si:H Solar Cell with Hexagonal Nano-Cylinder Array on Glass Substrate

W. C. Tu, Y. T. Chang, C. H. Yang, D. J. Yeh, C. I. Ho and S. C. Lee, National Taiwan Univ. (Taiwan)
A simple method of light trapping in a-Si:H solar cells was investigated. By nanosphere lithography, we patterned hexagonal nano-cylinder array on the glass substrate and reported 29% efficiency enhancement compared to the flat solar cell.

P-14-6

Application of sputtered ZnO_{1-x}S_x buffer layer for Cu(In, Ga)Se₂ solar cells

A. Okamoto, T. Minemoto and H. Takakura, Ritsumeikan Univ. (Japan)
We have applied the ZnO_{1-x}S_x by co-sputtering of ZnO and ZnS, which should have high controllability of the compositional ratios of O and S for the buffer layers of Cu(In,Ga)Se₂ solar cells.

P-14-7

Surface morphology and device performance of CuInS₂ solar cells prepared by single and two step evaporation methods

S. Fukamizu, T. Kondo, Y. Oda, T. Minemoto and H. Takakura, Ritsumeikan Univ. (Japan)
CuInS₂(CIS) films were fabricated by two-step evaporation methods that Cu-rich Cu-In-S deposited at 50 °C in the first step and In-S deposited in the second step to control good flatness and In-rich CIS films.

P-14-8

Improvement of Film Quality in CIS Thin Films Fabricated by Non-vacuum, Nanoparticles-based Approach

Y. Zhang^{1,2}, M. Ito², A. Yamada¹ and M. Konagai, ¹Tokyo Tech and ²Toppan Printing Corp., Ltd. (Japan)
A new approach to fabricate a high quality CIS thin film has been developed. The fabrication was carried out through using copper selenide (Cu-Se) nanoparticles, indium selenide (In-Se) nanoparticles, with thiourea.

P-14-9

Interpretation of Crossover in J-V Characteristics of Cu(In,Ga)Se₂ Solar Cell Using Lift-off Process

Y. Abe, T. Minemoto and H. Takakura, Ritsumeikan Univ. (Japan)
Although the photo J-V characteristics of the CIGS solar cell using a lift-off process were particular shape, this cause has not been interpreted yet. We investigated the behavior of photocurrent of the CIGS solar cells.

P-14-10

Simulation of temperature characteristics of InGaP/InGaAs/Ge triple-junction solar cell under concentrated light.

Y. Sakurada, Y. Ota and K. Nishioka, Univ. of Miyazaki (Japan)
Temperature characteristics of InGaP/InGaAs/Ge triple-junction solar cell under concentrated light conditions were calculated using SPICE. We can accurately estimate the temperature characteristics of triple junction solar cells under concentrated light.

P-14-11

Shallow Carrier Trap Levels in GaAsN Investigated by Photoluminescence

M. Inagaki¹, H. Suzuki², A. Suzuki, K. Mutaguchi, A. Fukuyama, N. Kojima¹, Y. Ohshita and M. Yamaguchi, ¹Toyota Technological Inst. and ²Univ. of Miyazaki (Japan)
The shallow carrier trap levels in GaAsN grown by chemical beam epitaxy were investigated by the temperature dependence of photoluminescence spectra. N-related trap level is ~17 meV below band edge with independently N composition.

P-14-12

Enhancement of the efficiency of GaAs-based solar cells by sol-gel-synthesized ZnO nanowire arrays as the antireflection layer

Y. K. Su, C. Y. Cheng, J. Y. Huang and Y. W. Lee, National Cheng Kung Univ. (Taiwan)
In recent decades, global-warming issues coupled with high oil prices, and photovoltaic is one of green energies which provide electricity without any pollution. We would like to develop high-efficiency and low-cost photovoltaics.

P-14-13

Fabrication of high quality TiO₂ thin films for high conversion efficiency dye-sensitized solar cells by multiple electrophoresis depositions

W. H. Chiu¹, K. M. Lee² and W. F. Hsieh^{1,3}, ¹National Chia Tung Univ., ²Indus. Tech. Res. Inst. and ³National Cheng Kung Univ. (Taiwan)
A multiple electrophoretic deposition (EPD) for binder-free deposition has been successfully developed to improve the TiO₂ photoanode quality, and the device gave a high efficiency up to 6.63% under AM 1.5G one sun irradiation.

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