

NDACANNUAL REPORT

2022 - **Vol. 1**



Message from the Director

The Kwangwoon University Nano Device Application Center is one of the most widely renowned hubs for the convergence of nanotechnology and ICT (information and communication technology), spearheading the era of the Fourth Industrial Revolution that embodies "hyper-connectivity, hyper-intelligence, and hyper-convergence." Since it was granted a research project in June 2018 for the Priority Research Institute Program in Science and Engineering that is supported by the National Research Foundation of Korea, which is funded by the Ministry of Education, our institute particularly directed its research focus toward essential advanced nano photonic/electronic materials and devices and their ICT applications based on multi-functional nano metasurfaces.

The NDAC boasts a globally competitive team of top-notch researchers and engineers with expertise in fields spanning nano materials, processes, devices, and systems. We are actively striving to achieve breakthroughs in world-benefiting research by securing innovative core technologies ranging from the fundamentals to advanced applications of nanotechnology. We are primarily tasked to function as a catalyst to enrich the competitiveness of, and contributions to the science and technology of South Korea and the entire globe by nurturing high-flying leaders who are equipped with creative and innovative minds.

Motivated to share the latest research achievements accomplished by the NDAC with the nanotechnology community as well as the domestic and overseas public audience, we have undertaken the preparation and issuing of the first volume of NDAC Research Achievement Report. I hope that this report serves as a convenient update on our research & development activities leading to noteworthy achievements that will eventually make the world a better and \square friendlier place to live in for everyone across the globe. Henceforth, we will continue to actively communicate with our readership via a variety of channels. Please join me in witnessing the NDAC reach its full potential and blossom into an indispensable organization in the fields of nanotechnology and ICT.

Sang-Shin Lee, Ph. D. Director Kwangwoon University Nano Device Application Center

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'98	Establishment of RFIC Center			
'00	Designated as "Excellent University Research Center" by the Ministry of Information and Communication			
'05	Signed an MOU with Singapore's Integrated Circuit and System Center for Electrical/Electronic Engineering			
'06	Signed an MOU with Thailand's " Chulalongkorn University"			
'08	Signed an MOU with Mongolia's "HUREE University of Information and Communication"			
'10	Signed an MOU with Nepal's "Tribhuvan University"			
'11	A joint research agreement with Kwangwoon University's ERC			
'12	Signed an MOU with China's "Qingdao University of Science and Technology"			
'13	RFIC Research Center opened in Mongolia, Nepal, and China within Asia ICT Research Institute			
'14	Signed an MOU with Australia's National University Laser Physics Centre			
'16	Changed the name to "Nano Device Application Center" (Director: Prof. Sang–Shin Lee)			
'18	Selection of support projects for university–focused research institutes in the field of science and engineering			
'18	Selection of companies designated for military service by university–affiliated research institutes			
'20	Selection of Korea–China cooperative project (joint seminar) (MOU agreement of "Jinan University" in China)			





I Nano Device Application Center



Nano Device Application Center (NDAC)



World-leading research center for nano devices and their applications

- Establish convergence center for advanced nano devices & ICT applications
- Research on multi-functional metasurface based devices
- Establish sustainable research network between academia-industry
- Training high level experts on nano devices & ICT applications
- Aim to publish 15 SCI journal papers (IF>5, Q1) per year
- International conference presentations (over 20 per year)
- Hold annual conferences with publishing annual report

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• Secure intellectual patents and seeking for sustainable growth model of the research center

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NDAC Research Goals



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NDAC Research Chain



International









Research Groups

Group |

Nano materials, fabrication and metasurface on devices



Prof. Sang-Shin Lee (Head director) slee@kw.ac.kr http://photonics.re.kr

Focused research area

- Nano materials and fabrication
- Metasurface applications



Prof. Hamin Park parkhamin@kw.ac.kr https://sites.google.com/view/park-andl/home

Focused research area

- 2D materials / new memory devices
- Semiconductor devices

Group ||

Nano bio, chem., environ. sensor and applications



Prof. Nam-Young Kim nykim@kw.ac.kr http://rficlab.kw.ac.kr

Focused research area

- Nano bio, chemistry sensors
- Environmental sensors



Prof. Jihoon Lee jihoonlee@kw.ac.kr http://aqnmol.kw.ac.kr/index.html

Focused research area

- Plasmonic and quantum applications
- Metasurface with nanostructures



Prof. Hyunsoo Kim hyunsookim@kw.ac.kr

Focused research area

- Smart biosensors
- Micro/nano devices for cell-based biomanufacturing and biomedical applications







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Center Introduction



Group III

ICT applications: circuits & optoelectronic devices



Prof. Eun-Soo Kim eskim@kw.ac.kr http://www.holodigilog.org

Focused research area

- Holo-reality
- ICT applications



Prof. Yun Seong Eo yseo71@kw.ac.kr http://www.rfcas.re.kr

Focused research area

- UWB and FMCW radar
- Wireless power transfer IC

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CMOS RF chip





Prof. Hyunho Lee hyunho@kw.ac.kr https://sites.google.com/view/qndl-kw

Focused research area

- Quantum dot and perovskite LEDs
- Emerging photovoltaic with perovskites

Prof. Hanwool Jeong hwjeong@kw.ac.kr http://sites.google.com/site/vlsicir

Focused research area

- Low voltage circuit design (SRAM)
- Computation-in-memory circuit design



NDAC Human Resources Project

From NDAC to the world

Research institutes, faculties in academia, industry...



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Current Researchers	Current Affiliation & Publication			
Dr. Stuart Aberdeen				
	 Current affiliation: NDAC (swa@kw.ac.kr) Acid resistant functionalised magnetic nanoparticles for radionuclide and heavy metal adsorption, J. Colloid Interface Sci., 608, 1728 (2022) The stability of SiO2@Fe3O4 nanoparticles for uranium extraction in acidic media, Waste Management Symposia 2020 Conference paper (2020) 			
Dr. Bao-Hua Zhu	 Current affiliation: NDAC (zhuwangwhy@hotmail.com) A quad-band bandpass filter using sept-mode double square-ring loaded resonator, Microwave and Optical Technology Letters, 62(5), 1906 (2020) On-Chip Miniaturized Bandpass Filter Using GaAs-Based Integrated Passive Device Technology For L-Band Application, Materials, 12(18), 3045 (2019) 			



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Current Researchers	Current Affiliation & Publication			
Dr. Jae-Hun Jeong	Current affiliation: NDAC (rexjh1226@kw.ac.kr)			
	 Improved Photoresponse of UV Photodetectors by the Incorporation of Plasmonic Nanoparticles on GaN Through the Resonant Coupling of Localized Surface Plasmon Resonance, Nano–Micro Letters, 12, 91 (2020) 			
	 CoP2 Nanoparticles Deposited on Nanometer–Thick Pt–Coated Fluorine–Doped Tin Oxide Substrates as Electrocatalysts for Simultaneous Hydrogen Evolution and Oxygen Evolution, ACS Applied Nano Materials, 2, 6507 (2020) 			
	 Hydrogen Peroxide Detection by Super–Porous Hybrid CuO/Pt NP Platform: Improved Sensitivity and Selectivity, Nanomaterials, 10, 2034 (2020) 			
Dr. Yong-Seok Hwang	Current affiliation: NDAC (thestone@kw.ac.kr)			
	 Compact full-color holographic 3–D display based on undersampled computer- generated holograms and oblique projection imaging, Optics Express, 28(24), 35910–35926 (2020) 			
	 Virtual–moving metalens array enabling light–field imaging with enhanced resolution, Advanced Optical Materials, 8(21), 2000820 (2020) 			
	• Field–of–view enhanced integral imaging with dual prism arrays based on perspective–dependent pixel mapping, Optics Express, 30(7), 11046 (2022)			

Previous Researchers	Current Affiliation & Publication			
	Current affiliation: Samsung Electro-Mechanics (skjdssky@naver.com)			
Dr. Chul–Soon Park	 Structural color filters based on an all-dielectric metasurface exploiting silicon-rich silicon nitride nanodisks, Optics Express, 27(2), 667–679 (2019) All-dielectric metasurface for simultaneously realizing polarization rotation and wavefront shaping of visible light, Nanoscale, 11(9), 4083–4090 (2019) A highly efficient bifunctional dielectric metasurface enabling polarization-tuned focusing and deflection for visible light, Advanced Optical Materials, 7(9), 1801337–1801345 (2019) Twofold polarization-selective all-dielectric tri-foci metalens for linearly polarized visible light, Advanced Optical Materials, 7(0), 1900883 (2019) Angle tolerant transmissive color filters exploiting metasurface incorporating hydrogenated amorphous silicon nanopillars, Chinese Optics Letters, 17(8), 8231 (2019) Multifunctional Beam Manipulation at Telecommunication Wavelengths Enabled by an All-Dielectric Metasurface Doublet, Advanced Optical Materials, 8(15), 2000645 (2020) Narrowband and Flexible Perfect Absorber Based on a Thin-film Nano-resonator Incorporating a Dielectric Overlay, Scientific Reports, 10, 17727 (2020) Virtual-moving metalens array enabling light-field imaging with enhanced resolution, Advanced Optical Materials, 8(21), 2000820 (2020) 			





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Previous Researchers	Current Affiliation & Publication		
	 Light-driven diffraction grating based on a photothermal actuator incorporating femtosecond laser-induced GO/rGO, Optics Express, 28(26), 35910-35926 (2020) Vivid Coloration and Broadband Perfect Absorption Based on Asymmetric Fabry-Pérot Nanocavities Incorporating Platinum, ACS Applied Nano Materials, 4(4), 4216-4225 (2021) All-Dielectric fiber meta-tip enabling vortex generation and beam collimation for optical interconnect, Laser & Photonics Reviews, 15(5), 2000581 (2021) Photoreduction-insensitive GO/rGO patterning based on multi-step fs-laser writing for implementing Fresnel zone plates, ACS Applied Nano Materials, 4(9), 9283-9292 (2021) 		
Dr. Su Han Kim	 Current affiliation: NDAC (tngkswkd0915@kw.ac.kr) Fast synthesis of large-scale single-crystal graphene with well-defined edges upon sodium chloride addition, Carbon, 158, 904–911 (2020) Performance optimization in gate-tunable Schottky junction solar cells with a light transparent and electric-field permeable graphene mesh on n–Si, Journal of Materials Chemistry C, 5, 3183–3187 (2017) 		
Dr. Sachin Mishra	 Current affiliation: NDAC (drsachinmishra13@gmail.com) Tailored Biofunctionalized Biosensor for the Label–Free Sensing of Prostate– Specific Antigen, ACS Applied Bio Materials, 3(11), 7821–7830 (2020) Ultrasensitive and Reusable Graphene Oxide–Modified Double– Interdigitated Capacitive (DIDC) Sensing Chip for Detecting SARSCoV-2, ACS sensors, 6, 3468– 3476 (2021) 		
Dr. Min-Kyu Park	 Current affiliation: Korea Photonics Technology Institute (min10624@naver.com) Virtual-moving metalens array enabling light-field imaging with enhanced resolution, Advanced Optical Materials, 8(21), 2000820 (2020) 		

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Previous Researchers	Current Affiliation & Publication					
	Current affiliation: Jiangnan University (liangjun1991@hotmail.com)					
Dr. Jun-Ge Liang	• Design and Realization of a Compact High–Frequency Band–Pass Filter with Low Insertion Loss Based on a Combination of a Circular–Shaped Spiral Inductor, Spiral Capacitor and Interdigital Capacitor, Electronics, 7, 195–201 (2018)					
125	• A high-frequency-compatible miniaturized bandpass filter with air-bridge structures using GaAs-based integrated passive device technology, Micromachines, 9, 463–472 (2018)					
	 Integrated passive device fabricated and chipon-board packaged filter employing mixed electric-magnetic coupling scheme, IET Microwaves, Antennas & Propagation, 12, 2191–2198 (2018) 					
	 QFN–Packaged Bandpass Filter With Intertwined Circular Spiral Inductor and Integrated Center–Located Capacitors Using Integrated Passive Device Technology, IEEE Access, 7, 13597–13607 (2019) 					
Dr. Chul-Soon Im						
	 Current affiliation: Hanwha Systems (tkdlqjtus@naver.com) Highly efficient broadband silicon nitride polarization beam splitter incorporating serially cascaded asymmetric directional couplers, Optics Letters, 45(21), 5974–5977 (2020) 					
Dr. Hee-Min Choi	Dr. Jae-Gwan Choi	Dr. Rahul Purbia	Dr. Dasaradha Rao Lambada			
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NDAC Research Outlook

Featured research



Group I

Photonics Research Lab.

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ANNUAL REPORT

Development of ultra-thin flat retroreflector technology for wireless optical communication link

A retroreflector, which retroreflects a laser beam emitted from a long distance, is mainly used as a passive transmitter that can send a signal while consuming very low power. Therefore, these retroreflectors are currently very suitable for application of laser tracking systems in the aerospace and defense industries, where active research is currently being conducted regarding their application. However, to establish a wireless optical communication system using unmanned aerial vehicles, artificial satellites, drones, and aircraft, the existing retroreflector structures (corner cube, cat's eye structure) require further improvement in terms of volume, weight, and cost effectiveness. In addition, a planar structure is required to directly make a modulator.







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Figure 3 Experimental setup and transfer characteristics of the fabricated flat retroreflector

To compensate for such shortcomings, an ultra-thin flat retroreflector with small volume and weight has been studied by using metasurface technology. The ultra-thin flat retroreflector consists of a metasurface that acts as a convex lens and a concave mirror in a stacked type configuration. A metasurface refers to a geometric plane composed of an array of hundreds of nanoscale 'metaatoms' structures, where the phase of light can be freely controlled. It operates in the near-infrared optical communication wavelength band, reflecting the incoming light from the outside, while simultaneously reflecting it back in parallel to the original direction. The flat retroreflector was examined for its potential as a wireless optical communication module. In the future, it will be possible to develop next-generation ultra-small wireless optical communication technology by mounting it on unmanned aerial vehicles.



Participant and Members





Group I

Advanced Nano Device Lab.

Prof. Hamin Park

Bias stress stability of thin-film transistors

MoS₂ thin–film transistors (TFTs) have been widely studied for use as driving TFTs of activematrix displays as a result of their outstanding electrical advantages, such as high mobility and high on/off current ratio. However, due to the atomically thin nature of MoS₂, the device performance of MoS₂ TFTs suffers from trap sites at the interface. In this study, a hybrid gate dielectric based on an interface engineering strategy using poly(1,3,5–trivinyl–1,3,5–trimethyl cyclotrisiloxane) (pV3D3) via initiated chemical vapor deposition is investigated to enhance the negative bias illumination stress (NBIS) stability of MoS₂ TFTs. Compared to a single oxide dielectric layer (Al₂O₃), a hybrid dielectric layer (pV3D3/Al₂O₃) exhibits decreased threshold voltage shift under NBIS by reducing functional groups, such as hydroxyl (OH⁻) group, which act as charge trapping sites at the interface between the MoS₂ channel and the gate dielectric. This is confirmed by quantitative analysis using the stretched–exponential model. Tau (τ), one of the modeling parameters in the stretched–exponential model, decreases from 210 to 120 s, indicating the improvement in stability. Furthermore, in a low–frequency noise (1/f) measurement, hybrid–dielectric–based TFTs show an order of magnitude lower noise power spectral density (S_{ID}/I_D²) than single–oxide–dielectric–based TFTs.



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Figure 1 Schematic, material properties, and IV characteristics of MoS₂ thin-film transistors (TFTs).

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Figure 2 Transfer curves under the negative bias illumination stress (NBIS) of (a) single and (b) hybrid dielectric thin-film transistors (TFTs). (c) Time-dependent Vth shift and (d) modeling parameters (τ and β) of the single and hybrid dielectric TFTs.



Figure 3 Normalized noise power spectral density (S_{ID}/I_D^2) as a function of (a-b) the frequency and (c-d) the drain current of single and hybrid dielectric thin-film transistors (TFTs).

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Participant and Members











Group II

RFIC Lab.

Prof. Nam-Young Kim

Development of facilely fabricated biosensor platform for COVID-19 detection based on localized surface plasmon resonance

The localized surface plasmon resonance (LSPR) is the collective oscillation of electrons of conductive nano-structure excited by emitted light, resulting in a certain wavelength absorption due to the reaction of incident light and the excited electromagnetic field. LSPR is attractive for biosensing applications benefiting from the low bulk effect and high sensitivity in bio-molecular detection. The performance of LSPR-based biosensors has strict requirements for nanostructures to achieve high sensitivity, and consequently, various fabrication methods have been researched and applied to biosensor development, such as chemical synthesis, thermal aggregation, and electron beam lithography. However, currently they suffer from the integration with other devices and high-cost. Hence, here we have proposed and researched the anodic aluminum oxide template-assisted fabrication method, to facilely and cost-effectively implement a highly ordered method nanoparticles array. The effect of template dimension on nanoparticles array and sensing performance has been researched, and various biosensors with different sizes have been successfully fabricated using silver nanoparticles with optimized sensitivity. The highly selective detection of COVID-19 can be realized by immobilizing coronavirus antibodies onto the surface of the silver nanoparticles.

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Fabrication Process for Passive Devices



Figure 1 Conceptual figure and fabrication process of LSPR-based biosensor platform using AgNPs array



| Figure 2 |

(a) Conceptual figure and fabrication process of LSPR-based biosensor platform using AgNPs array (b) Basic performance and characterization of fabricated 3-type devices: 30 nm, 65 nm, and 90 nm

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| Figure 3 |

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(a) Characterization of ordered AgNPs array

(b) Reusability test of C-type devices using 50 wt% sucrose solution by optical spectrum, surface morphology and NPs array distributions

Participant and Members









IV



Group II

Advanced Quantum-Nano Materials & Optoelectronics Lab.

Prof. Jihoon Lee

Exploring advanced optoelectronic and functional devices with advanced quantum- & nano-structures and materials

AQNMOL is dedicated to exploring the potentials of advanced optoelectronic and functional devices and technologies that consume less energy, produce energy, offer higher performance & efficiency, i.e. photodetectors, sensors, energy generation, photovoltaics (PV) and light emitting diode (LEDs), etc. The advancement and development of energy saving & highly– efficient applications heavily reply on the improvement of novel quantum– and nano–structures and associated material systems. AQNMOL focuses on the fabrication & characterization of advanced quantum– and nano–structures and materials & related device applications by unique Physio–Chemical approaches combining the physical vapor deposition (PVD) of the pulsed laser deposition (PLD), sputtering, rapid thermal process (RTP) and chemical solution–based synthesis of the spin coating, electrochemical and potentiostat.



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Physicochemical research utilizes the advantages of both physical and chemical synthesis and fabrication, which can offer advanced hybrid nanostructures and devices. The characterization of such devices utilizes various equipment such as atomic force microscope (AFM), scanning electron microscope (SEM), energy dispersive x-ray spectroscope (EDS), Raman, photoluminescence (PL), UV-VIS spectroscopy, I-V (Photo response) measurements, X-ray diffraction (XRD) spectroscopy, X-ray photoelectron spectroscopy (XPS), electrochemical analysis and fabrications (CV, CA, LSV and EIS), simulations using finite-difference time domain (FDTD), Origin, Sigma plot, etc.



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IV



Group II

Biosensing Systems Lab.

Prof. Hyun Soo Kim

Microfluidics technologies and systems

Microfluidics, a technology that can accurately control extremely small quantities of liquid samples, together with various micro/nano fabrication technologies, enable the concept of labon-a-chip systems. The lab-on-chip concept, which is building an entire life science or chemistry lab on a chip, allows integration of multiple functional components into a single system that can perform all the necessary steps for a particular procedure, from sample preparation to sample analysis, with minimum manual intervention. We are interested in solving grand challenge problems in the broad area of energy and environment through the use of microfluidic system technologies. Here two of our research themes will be presented. Firstly, smart biosensors that allow on-site diagnosis for medical monitoring. These sensors can be fabricated at significantly lower cost compared to any existing methods and can be further improved by integrating it with a wireless communication module for convenient clinical applications or point-of-care system.



Figure 1 (a) Paper microfluidics-based sensors and (b) wearable biosensors for healthcare monitoring

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Secondly, microsystems that enable single-cell resolution analysis. Various high-throughput microfluidic systems as photosynthetic organism screening/analyses platforms that are currently being used to identify and define metabolic processes and genetic constraints that significantly enhance high-value biomolecule production and growth of microalgae will be introduced. These systems are also capable of a variety of functions to replace routine biomedical analysis and diagnostics, highlighting a higher-level system integration with improved potential for automation, control, and high-throughput processing, while consuming a small volume of samples and reagents at shorter bioassay times and reduced cost.



| Figure 2 | (a) Schematic image of high-throughput single cell screening system. It can be used for screening high value material and bioenergy production or microbe strain development/recovery. (b) Microsystems for biomedical applications. It can be used cancer diagnosis system, personalized anti-cancer drug screening system, on-site sample-in/answer-out PCR system.

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Group III

3DRC / HoloDigilog Human Media Research Center

Prof. Eun-Soo Kim

Development of novel real-time 3D asymmetric integral imaging (AII) with long depth range and high resolution

A new asymmetric integral imaging system for real-time pickup and three-dimensional (3–D) visualization of far outdoor scenes based on dynamic-pixel-mapping (DPM) is proposed. DPM is a digital process to transform the elemental images captured with a lens array into the perspective-variant object images (POIs), whose structures are matched with those of display lenses, where the orders of pixels in each POI are reversely mapped, and then capture a set of virtual elemental images (EIs) at the specific depth planes from the back-propagated POIs. This DPM enables an asymmetrical use of pickup and display lens arrays, allowing the long-range pickup of far outdoor scenes and their resolution-enhanced 3–D reconstruction. Experiments with a pair of pickup and display lens arrays whose pitches and focal lengths are given by 7.5mm, 30mm and 1.2mm, 8mm, respectively. This shows that the effective pickup-range and resolution of the proposed system have been increased up to 6m and 1,600×1,600 pixels, respectively, from 0.064m and 480×480 pixels of the conventional systems employing the same pickup and display lens arrays.



Figure 1 Conceptual diagram of the proposed Allbased 3-D video tele-education system



| Figure 2 | Experimental Set-up showing a pick-up system and display system of All system

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Full-color High Transparent VHOE HoloGlass Digital Signage Display for Al Holo-Avatar

We propose augmented reality(AR) HoloGlass Digital Signage Display for Al Holo–Avatar, which is holographic diffusing projection display established by use of photopolymer based full–color holographic diffusing diffraction film. Utilizing high optical qualities such as high transparency and high diffraction efficiency. To form diffusing diffraction pattern keeping high transparency. We have fabricated the unique scattering holographic plate with wide viewing zone including the effective removal of color dispersion.





IV



| Figure 7 | The reconstruction for incidence of a white image of 'K' (a), (b), (c) on the single VHOE constructed from off-axis incidence and on-axis reconstruction beam and (d), (e), (f) on multiple VHOE designed to be compensated at condition constructed from off-axis input reference beam and on-axis reconstruction beam

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Group III

Quantum & Nano Display Lab.

Prof. Hyunho Lee

Stability analysis of perovskite optoelectronics

The stability of methylammonium (MA)–based perovskite solar cells (PSCs) remains one of the most urgent challenges that needs to be addressed. The degradation of perovskite films under light exposure accelerates the deterioration of the device, mainly due to the migration of halide ions. In this study, we investigated the effect of light energy on the degradation of inverted PSCs by introducing red ($\lambda = 610-800$ nm), green (500–590 nm), and blue (300–500 nm) light–pass filters. Direct evidence of light–induced degradation was obtained by investigating morphological changes in the perovskite films and the amount of ion accumulation on the Ag electrode. Furthermore, to minimize light–induced device degradation, we designed two types of blue cut–off filters that can selectively block light ranging from $\lambda = 400$ to 500 nm, comprising a multilayered inorganic metasurface. An optical simulation was used to optimize the performance of the designed filters. By investigating the changes in the photovoltaic parameters and the amount of ion accumulation on the Ag electrode, we confirmed that integrating blue cut–off filters into PSCs greatly improved the operational lifetime of the devices.



Figure 1 (a) Cross-sectional TEM image of a PSC. (b) Photovoltaic performance of the PSCs when illuminated with incident light of different energies for 30 h. White represents the photovoltaic performance over 30 h of illumination with no filter. Blue, green, and red represent the photovoltaic performances over 30 h of degradation with the corresponding color filters. Normalized long-term degradation trends are presented for (c) PCE, (d) J_{SC} (short circuit current density), (e) FF (fill factor), and (f) V_{OC} (open circuit voltage).



NDAC ANNUAL REPORT

Research Outlook

IV



Figure 2 Blue cut-off filter formed by multi-layered metasurfaces on the glass. (a), (d) Structure of the multi-layered BC-1 and BC-2 metasurface cut-off filters. (b), (e) Cross-sectional TEM image of BC-1 and BC-2

(inset: photographs of PSCs employing BC-1 and BC-2.). (c) Simulated reflectance of PSCs integrated with BC-1 (black) and BC-2 (red). (f) Experimentally determined reflectance of PSCs integrated with BC-1 (black) and BC-2 (red).



Figure 3 Figure 3. (a) Photovoltaic performance of the PCSs with blue cut-off filters. BC-1 and BC-2 represent the photovoltaic performances with blue cut-off filter 1 and blue cut-off filter 2. Normalized long-term degradation trends of (b) PCE, (d) J_{SC} , (e) FF, and (f) V_{OC} . (c) Incident photon-to-electron conversion efficiency (IPCE) spectra and integrated current density of the PSCs incorporating BC-1 and BC-2.



IV

Balanced charge injection for efficient quantum dot light-emitting diodes (QLEDs)

The efficient radiative recombination process in the emission layer is required for developing efficient QLEDs. Several loss mechanisms can be presented in QLEDs, such as, Interfacial trap states in charge transporting layers (CTLs), defect sites on QDs and charge injection imbalance which can hinder the device performance of QLEDs significantly. In particularly, Auger recombination has been widely known as the primary loss mechanism, causing severe non-radiative recombination with excess charge injection to QDs. To achieve radiative recombination without severe loss mechanism, the efficient and balanced charge injection into emission layer (QD) is needed. Here, we have introduced novel passivation steps on the synthesis of electron transport layer. The modification on magnesium doped ZnO nanoparticle (ZMO NP) is employed to suppress the electron injection to the InP QD layer. The passivation on ZMO NPs effectively replaces hydroxyl groups to electrically stable states, retarding electron injection through the ZMO NP layer. The modified ZMO NP based InP QLED exhibit a maximum external quantum efficiency (EQE) of 9.6% with a significantly enhanced operational lifetime.



Figure 4 TEM images of (a) C-ZMO and (b) M-ZMO. The inset on the right-top represents the magnified TEM images with inter planar d-spacings. (c) XRD patterns of C-ZMO (blue) and M-ZMO (red) powders. SAED pattern of (d) C-ZMO and (e) M-ZMO. (f) UPS of C-ZMO (blue) and M-ZMO (red) film on the glass substrate. The measured energy level diagram for C-ZMO (blue) and M-ZMO (red) is presented.

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| Figure 5 | (a) Schematic of the device structure. (b) Cross-TEM image of the InP QLED. (c) J-V-L characteristics of C-ZMO (blue) and M-ZMO (red) based devices. (d) EQE of C-ZMO (blue) and M-ZMO (red) based devices with respect to luminance. (e) Electroluminescence (EL) spectra of C-ZMO (blue) and M-ZMO (red) based devices.



Participant and Members





Group III

VLSI Circuit Design Lab.

Prof. Hanwool Jeong

Design of variation-aware training algorithm for Computing-in-Memory architecture

After the emergence of deep learning, the importance of energy–efficient data processing has increased very rapidly, due to the limitation of conventional von Neumann computing architecture. With respect to the energy efficiency of von Neumann architecture, especially for deep learning, numerous data transfer and multiplication–and–accumulation (i.e., MAC) processes incur an energy overhead. To solve this problem, the research area called 'Computing–in–Memory' (i.e., CIM) was proposed, which introduces novel computing architecture that enable memories (e.g., SRAM, ReRAM, MRAM, etc.) to process AI algorithms such as image classification.



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Figure 2 The source of implementable hardware variations: Bitcell Array (BCA) and ADC

However, since CIM is based on analog memories, many process variations lower the performance of CIM architecture such as inference accuracy. Therefore, we are conducting research of designing variation-aware training algorithm which can improve the accuracy degradation issue caused by process variations. The variation-aware training algorithm adopts the numerical hardware variation model and applies it to its own baseline neural network, allowing it to learn the variation-optimized weights. Our research goal is to reduce the gap of inference accuracy between software baseline and CIM hardware.



Figure 3 A diagram explaining the hardware-friendly neural network architecture which is the basis of variation-aware training algorithm



Figure 4 Figure 4. The example of hardware variation modeling: MAC processing via bitcell array

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교육부



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NDAC Facilities



High TEMP. Convention Dry Oven



HEPA Vacuum Oven



Micro Reflectance Vision System



Spin Coater



Hotplate



4-Probe Station System



Fume Hood



Wet Station



Wet Station



Mini-SEM

NDAC



Profilm 3D

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Current Preamplifier

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Tunable Laser





Femtosecond Laser System

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LCR Meter



Impedance Analyzer



Dynamic Signal Analyzer



Glovebox

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Thermal Evaporator

NDAC Research Achievements

Journal Papers

VII

1st Phase Paper List

• Year 1 (2018.03.-2019.02.)

Group	Paper Name	Journal Name	Author
	Highly sensitive electro-optic probe incorporating an ultra- high Q-factor LiNbO3 etalon	Applied Optics	Woo-Bin Lee et al.
	Structural color filters based on an all-dielectric metasur- face exploiting silicon-rich silicon nitride nanodisks	Optics Express	Chul–Soon Park et al.
	Determination of geometry-induced positional distortion of ultrafast laser-inscribed circuits in a cylindrical optical fiber	Optics Letters	Peng Ji et al.
1	All-dielectric metasurfaces for simultaneously realizing polarization rotation and wavefront shaping of visible light	Nanoscale	Song Gao et al.
	A highly efficient bifunctional dielectric metasurface enabling polarization-tuned focusing and deflection for visible light	Advanced Optical Materials	Song Gao et al.
	Fiber-optic refractometer based on a reflective aspheric prism rendering adjustable sensitivity	Journal of Lightwave Technology	Changyi Zhou et al.
2	Plasmonic Pt nanocrystals by using a sacrificial in component via the enhanced dewetting on sapphire (0001): improvement on morphological and localized surface plasmon resonance properties	Journal of Physical Chemistry C	Sundar Kunwar et al.
	Modification of dewetting characteristics for the improved morphology and optical properties of platinum nanostructures using a sacrificial indium layer	PLOS ONE	Puran Pandey et al.
	Improved control on the morphology and LSPR properties of plasmonic Pt NPs through enhanced solid state dewetting by using a sacrificial indium layer	RSC Advances	Sundar Kunwar et al.
	Improved configuration and LSPR response of platinum nanoparticles via enhanced solid state dewetting of In-Pt bilayers	Scientific Reports	Sundar Kunwar et al.
	Improved LSPR properties of Ag–Pt and Pt nanoparticles: A systematic study on various configurations and compositions of NPs via the solid-state dewetting of Ag– Pt bilayers	Metals	Sanchaya Pandit et al.
	Design and realization of a compact high-frequency band- pass filter with low insertion loss based on a combination of a circular-shaped spiral inductor, spiral capacitor and interdigital capacitor	Electronics	Ki-Hun Lee et al.
	A high-frequency-compatible miniaturized bandpass filter with air-bridge structures using GaAs-based integrated passive device technology	Micromachines	Zhi–Ji Wang et al.
	Microfabricated passive resonator biochip for sensitive radiofrequency detection and characterization of glucose	RSC Advances	Gyan Raj Koirala et al.





Group	Paper Name	Journal Name	Author
	Micro-resonator based bivariate detection of glucose concentration with phenylboronic acid functionalized reduced graphene oxide	IEEE Access	Gyan Raj Koirala et al.
	Integrated passive device fabricated and chipon-board packaged filter employing mixed electric-magnetic coupling scheme	IET Microwaves, Antennas & Propagation	Jun-Ge Liang et al.
	QFN-packaged bandpass filter with intertwined circular spiral inductor and integrated center-located capacitors using integrated passive device technology	IEEE Access	Zhi-ji Wang et al.

• Year 2 (2019.03.-2020.02.)

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Group	Paper Name	Journal Name	Author
1	Femtosecond-laser-assisted implementation of an inline power tap in a multimode fiber	Optics Letters	Peng Ji et al.
	Fiber reshaping-based refractive index sensor interrogated through both intensity and wavelength detection	Sensors	Peng Ji et al.
	Twofold polarization-selective all-dielectric trifoci metalens for linearly polarized visible light	Advanced Optical Materials	Song Gao et al.
	Angle tolerant transmissive color filters exploiting metasurface incorporating hydrogenated amorphous silicon nanopillars	Chinese Optics Letters	lshwor Koirala et al.
	28–Gbps interconnect based on a plastic optical engine providing reduced modal dispersion	Optics Communications	Yong-Geon Lee et al.
	Angle tolerant transmissive color filters exploiting metasurface incorporating hydrogenated amorphous silicon nanopillars	Chinese Optics Letters	lshwor Koirala et al.
2	Modified solid state dewetting of plasmonic Pt NPs by using In–Pt bi–layer system: improvement on the surface morphology and LSPR properties of Pt NPs	IEEE Transactions on Nanotechnology	Puran Pandey et al.
	Fabrication of various plasmonic Pt nanostructures via indium assisted solid-state dewetting: from small nanoparticles to widely connected networks	Nanomaterials	Sanchaya Pandit et al.
	Enhanced localized surface plasmon resonance of fully alloyed AgAuPdPt, AgAuPt, AuPt, AgPt, and Pt nanocrystals: Systematical investigation on the morphological and LSPR properties of mono-, bi-, tri-, and quad-metallic nanoparticles	ACS Omega	Sundar Kunwar et al.
	Improved morphological and localized surface plasmon resonance (LSPR) properties of fully alloyed bimetallic AgPt and monometallic Pt NPs via the one-step solid-state dewetting (SSD) of the Ag/Pt bilayers	Nanoscale Research Letters	Sundar Kunwar et al.
	Strongly confined localized surface plasmon resonance (LSPR) bands of Pt, AgPt, AgAuPt nanoparticles	Scientific Reports	Mao Sui et al.
	Improved localized surface plasmon resonance responses of multi-metallic Ag/Pt/Au/Pd nanostructures: systematic study on the fabrication mechanism and localized surface plasmon resonance properties by solid-state dewetting	New Journal of Physics	Mao Sui et al.





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Group	Paper Name	Journal Name	Author
	Solid state dewetting of Ag/Pt bilayers for the stronger localized surface plasmon resonance (LSPR) properties: The dynamic control of surface morphology and elemental composition of AgPt and Pt nanostructures by the auxiliary Ag layer	Journal of Alloys and Compounds	Puran Pandey et al.
	Tunable localized surface plasmon resonance by self- assembly of trimetallic and bimetallic alloy nanoparticles via Ag sublimation from Ag/Au/Pt tri-layers	Applied Surface Science	Sundar Kunwar et al.
	On-chip miniaturized bandpass filter using GaAs-based integrated passive device technology for L-band application	Materials	Bao-Hua Zhu et al.
	Perovskite-induced ultrasensitive and highly stable humidity sensor systems prepared by aerosol deposition at room temperature	Advanced Functional Materials	Myung-Yeon Cho et al.
	A quad-band bandpass filter using sept-mode double square-ring loaded resonator	Microwave and Optical Technology Letters	Bao-Hua Zhu et al.
	Nanoscale FET-based transduction toward sensitive extended-gate biosensors	ACS Sensors	Jae Kwon et al.
	pH sensing characteristics of extended-gate field-effect transistor with Al2O3 layer	Journal of Nanoscience and Nanotechnology	Jae Kwon et al.
	Dual-view three-dimensional display based on direct- projection integral imaging with convex mirror arrays	Applied Sciences	Hee-Min Choi et al.
	Alignment-tolerant single-shot digital holographic microscopy based on computer-controlled telecentricity	Applied Optics	Seong–Jin Park et al.
3	Full-scale one-dimensional NLUT method for accelerated generation of holographic videos with the least memory capacity	Optics Express	Hong-Kun Cao et al.
	Single SLM full-color holographic three-dimensional video display based on image and frequency-shift multiplexing	Optics Express	Shu-Feng Lin et al.
	Faster generation of holographic videos of objects moving in space using a spherical hologram-based 3-D rotational motion compensation scheme	Optics Express	Hong-Kun Cao et al.

Year 3 (2020.03.-2021.02.)

Group	Paper Name	Journal Name	Author
1	Linearity–enhanced refractometric sensor utilizing ultra–high numerical aperture fiber combined with a plastic prism	IEEE Sensors Journal	Changyi Zhou et al.
	Multifunctional beam manipulation at telecommunication wavelengths enabled by an all-dielectric metasurface doublet	Advanced Optical Materials	Changyi Zhou et al.
	Narrowband and flexible perfect absorber based on a thin- film nano-resonator incorporating a dielectric overlay	Scientific Reports	Chul–Soon Park et al.
	Highly efficient broadband silicon nitride polarization beam splitter incorporating serially cascaded asymmetric directional couplers	Optics Letters	Bishal Bhandari et al.
	Virtual-moving metalens array enabling light-field imaging with enhanced resolution	Advanced Optical Materials	Min-Kyu Park et al.







Group	Paper Name	Journal Name	Author
	Light–driven diffraction grating based on a photothermal actuator incorporating femtosecond laser–induced GO/rGO	Optics Express	Shiru Jiang et al.
	Improved photoresponse of UV photodetectors by the incorporation of plasmonic nanoparticles on GaN through the resonant coupling of localized surface plasmon resonance	Nano-Micro Letters	Sundar Kunwar et al.
	Fabrication of Au network by low-degree solid state dewetting: continuous plasmon resonance over visible to infrared region	Acta Materialia	Jiliang Liu et al.
	Self–assembled AI nanostructure/ZnO quantum dot heterostructures for high responsivity and fast UV photodetector	Nano-Micro Letters	Sisi Liu et al.
	CoP2 nanoparticles deposited on nanometer-thick Pt- coated fluorine-doped tin oxide substrates as electrocatalysts for simultaneous hydrogen evolution and oxygen evolution	ACS Applied Nano Materials	Jae-Hun Jeong et al.
	Hydrogen peroxide detection by super–porous hybrid CuO/Pt NP platform: improved sensitivity and selectivity	Nanomaterials	Rakesh Kulkarni et al.
	Enhanced spatial light confinement of all inorganic perovskite photodetectors based on hybrid plasmonic nanostructures	Small	Ming-Yu Li et al.
2	Hybrid device architecture using plasmonic nanoparticles, graphene quantum dots, and titanium dioxide for UV photodetectors	ACS Applied Materials & Interfaces	Sundar Kunwar et al.
	Fabrication of hybrid Pd@Ag core–shell and fully alloyed bi– metallic AgPd NPs and SERS enhancement of Rhodamine 6G by a unique mixture approach with graphene quantum dots	Applied Surface Science	Sanchaya Pandit et al.
	Fabrication of QFN-packaged miniaturized GaAs-based bandpass filter with intertwined inductors and dendritic capacitor	Materials	Jian Chen et al.
	A compact dual-mode bandpass filter with high out-of- band suppression using a stub-loaded resonator based on the GaAs IPD process	Electronics	Wei Zhang et al.
	High–sensitivity, quantified, linear and mediator–free resonator–based microwave biosensor for glucose detection	Sensors	Alok Kumar et al.
	Tailored biofunctionalized biosensor for the label-free sensing of prostate-specific antigen	ACS Applied Bio Materials	Sachin Mishra et al.
	Highly efficient transfection effect of transdermal drug delivery via skin by hybrid bipolar arc plasma stimulation and dual pulse electroporation technique	IEEE Access	Eun-Seong Kim et al.
	Aptamer–based field–effect transistor for detection of avian influenza virus in chicken serum	Analytical Chemistry	Jae Kwon et al.
	Understanding the signal amplification in dual–gate FET– based biosensors	Journal of Applied Physics	Jae-Hyuk Ahn et al.
3	Compact full-color holographic 3–D display based on undersampled computer-generated holograms and oblique projection imaging	Optics Express	Hong-Kun Cao et al.





2nd Phase Paper List

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• Year 1 (2021.03.-2022.02.)

Group	Paper Name	Journal Name	Author
	Efficient all–dielectric diatomic metasurface for linear polarization generation and 1–bit phase control	ACS Applied Materials & Interfaces	Song Gao et al.
	Vivid coloration and broadband perfect absorption based on asymmetric Fabry–Pérot nanocavities incorporating platinum	ACS Applied Nano Materials	Chul–Soon Park et al.
	All-dielectric fiber meta-tip enabling vortex generation and beam collimation for optical interconnect	Laser & Photonics Reviews	Changyi Zhou et al.
1	Flat retroreflector based on a metasurface doublet enabling reliable and angle-tolerant free-space optical link	Advanced Optical Materials	Hongliang Li et al.
	Photoreduction-insensitive GO/rGO patterning based on multistep femtosecond laser writing for implementing fresnel zone plates	ACS Applied Nano Materials	Shiru Jiang et al.
	Flat telescope based on an all-dielectric metasurface doublet enabling polarization-controllable enhanced beam steering	Nanophotonics	Hongliang Li et al.
	Metasurface doublet-integrated bidirectional grating antenna enabling enhanced wavelength-tuned beam steering	Photonics Research	Woo-Bin Lee et al.
	Dual–step hybrid SERS scheme through the blending of CV and MoS2 NPs on the AuPt core–shell hybrid NPs	Journal of Materials Science & Technology	Rutuja Mandavkar et al.
	Hybridization of 2D MoS2 nanoplatelets and PtAu hybrid nanoparticles for the SERS enhancement of methylene blue	Advanced Materials Interfaces	Shusen Lin et al.
	Significantly improved photo carrier injection by the MoS2/ZnO/HNP hybrid UV photodetector architecture	Applied Surface Science	Rutuja Mandavkar et al.
	High performance hybrid MXene nanosheet/CsPbBr3 quantum dot photodetectors with an excellent stability	Journal of Alloys and Compounds	Hao Li et al.
2	Ultra-fast and recyclable DNA biosensor for point-of- care detection of SARS-CoV-2 (COVID-19)	Biosensors and Bioelectronics	Chuljin Hwang et al.
	Ultrasensitive and reusable graphene oxide-modified double-interdigitated capacitive (DIDC) sensing chip for detecting SARSCoV-2	ACS Sensors	Parshant Kumar Sharma et al.
	Perspectives on 2D–borophene flatland for smart bio– sensing	Materials Letters	Parshant Kumar Sharma et al.
	Wearable intracranial pressure monitoring sensor for infants	Biosensors	Baoyue Zhang et al.
	Direct removal of harmful cyanobacterial species by adsorption process and their potential use as a lipid source	Chemical Engineering Journal	Yun Hwan Park et al.





Group	Paper Name	Journal Name	Author
	Microalgal secondary metabolite productions as a component of biorefinery: A review	Bioresource Technology	Yun Hwan Park et al.
	Hand-held raman spectrometer-based dual detection of creatinine and cortisol in human sweat using silver nanoflakes	Analytical Chemistry	Hyun Soo Kim et al.
	MoS2 Nanoflake and ZnO Quantum Dot Blended Active Layers on AuPd Nanoparticles for UV Photodetectors	ACS Applied Nano Materials	Shusen Lin et al.
	Design and Micro-Nano Fabrication of a GaAs-Based On-Chip Miniaturized Bandpass Filter with Intertwined Inductors and Circinate Capacitor Using Integrated Passive Device Technology	Nanomaterials	Jian Chen et al.
2	Current status and perspective of colored photovoltaic modules	WIREs Energy and Environment	Hyunho Lee et al.
3	Liq interlayer as electron extraction layer for highly efficient and stable perovskite solar cells	International Journal of Energy Research	Kunsik An et al.

• Year 2 (2022.03-)

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Group	Paper Name	Journal Name	Author
1	Flat optical phased array receiver incorporating an on-chip metalens concetrator	Optics Letters	Chul–Soon Im et al.
	Dielectric polarization–filtering metasurface doublet for trifunctional control of full–space visible light	Laser & Photonics Reviews	Song Gao et al.
	Reconfigurable fiber-to-waveguide coupling module enabled by phase-change material incorporated switchable directional couplers	Scientific Reports	Bishal Bhandari et al.
	Quantification of doping state of redox sensitive nanoparticles for probing the invasiveness of cancer cells using surface enhanced Raman scattering	Materials Today Bio	Jaehun Lee et al.
2	Dual-step photocarrier injection by mixture layer of ZnO QDs and MoS2 NPs on hybrid PdAu NPs	Materials Research Bulletin	Rutuja Mandavkar et al.
۷	Design of boron-based ternary W3CoB3 electrocatalyst for the improved HER and OER performances	Materials Today Energy	Md Ahasan Habib et al.
	Surmounting the interband threshold limit by the hot electron excitation of multi–metallic plasmonic AgAuCu NPs for UV photodetector application	CrystEngComm	Shusen Lin et al.
3	Field–of–view enhanced integral imaging with dual prism arrays based on perspective–dependent pixel mapping	Optics Express	Hee-Min Choi et al.
	Transient Dynamics of Charges and Excitons in Quantum Dot Light–Emitting Diodes	Small	Jaeyoul Kim et al.



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Conference Presentations

1st Phase Conferences Presentation

• Year 1 (2018.03.-2019.02.)

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Group	Paper Name	Conference Name	Author
	Inline power sensor in multimode fiber based on high- intensity femtosecond laser writing	26th International Conference on Optical Fibre Sensors	Peng Ji et al.
	Highly efficient bifunctional dielectric metasurface enabling polarization-tuned focusing and steering for visible light	Photonics Conference 2018	Song Gao et al.
	Color generation based on all-dielectric metasurfaces exploiting silicon-rich silicon nitride nanodisks embedded in polymeric layer	Photonics Conference 2018	Chul-Soon Park et al.
	Direct femtosecond laser writing of inline multi- channel optical power monitor in a multicore fiber	Photonics Conference 2018	Peng Ji et al.
1	비대칭 집적영상 기법에서 동적 픽셀 매핑 기법을 이용한 부분적으로 가려진 3 차원 물체의 장애물 제거 방법	Photonics Conference 2018	Jae-Gwan Choi et al.
	25-Gbps 인터커넥트용 인캡슐형 광 엔진	Photonics Conference 2018	Yong-Geon Lee et al.
	광 시역 카메라 어레이를 이용한 증가된 시역을 갖는 프로젝션 집적 영상 시스템	Photonics Conference 2018	Hee-Min Choi et al.
	Sensitivity-stabilized electro-optic probe incorporating integrated field sensing tip for near-field scanning	Photonics Conference 2018	Seon-U Baek et al.
	Tunable color filters via one-dimensional silicon-rich silicon nitride metasurface based on resonant waveguide grating	Photonics Conference 2018	lshwor Koirala et al.
	Analysis of thermo–optic modulator on SiN platform	Photonics Conference 2019	Om Raj Sapkota et al.
	Control on the configuration and size of PdAg and AuPd alloy NPs via solid state dewetting of bilayer on sapphire (0001)	2018 Collaborative Conference on Materials Research	Puran Pandey et al.
	Dewetting of multimetallic thin films on sapphire (0001): Study on the evolution of surface morphology and optical properites	2018 Collaborative Conference on Materials Research	Sundar Kunwar et al.
2	Influence of sacreficial In layer on the evolution of well-defined Pt NPs on sapphire (0001)	2018 Collaborative Conference on Materials Research	Puran Pandey et al.
	Improved configuration of plasmonic metal nanoparticles via enhanced dewetting by using a sacrificial layer	2018 Collaborative Conference on Materials Research	Sundar Kunwar et al.
	Aerosol deposited BaTiO3–Ag film for RF inter–digital capacitor humidity sensing	Korean Institute of Electromagnetic Engineering and Science 2019	Eun-Seong Kim et al.
	Inter–digital capacitor with aerosol deposited BaTiO3 film for RF capacitive sensing applications	Korean Institute of Electro magnetic Engineering and	Young–Dae Sim et al.







Group	Paper Name	Conference Name	Author
		Science 2019	
	Miniaturized bandpass filter with intertwined spiral inductor and center-located capacitor by Integrated passive device technology	Korean Institute of Electro magnetic Engineering and Science 2019	Chul-Ho Kang et al.
	Realization of miniaturized bandpass filter with intertwined inductors and dendritic capacitor on GaAs substrate	Korean Institute of Electro magnetic Engineering and Science 2019	Jian Chen et al.
	A compact bandpass filter with combination of a circle-shaped spiral inductor and a circular interdigital capacitor by IPD process	Korean Institute of Electro magnetic Engineering and Science 2019	Ki–Hun Lee et al.
	Micro-fabricated interdigital capacitor for RF-based label-free bio-sensing applications	Korean Institute of Electro magnetic Engineering and Science 2019	Zhi-Ji Wang et al.
	A compact bandpass filter with spiral inductor and center–embedded meandered capacitor on GaAs substrates	Korean Institute of Electro magnetic Engineering and Science 2019	Bao-Hua Zhu et al.
	균일한 빔 분포를 가지는 홀로그래픽 백라이트 시스템 적용 위한 전반사 참조 빔 생성 광 도파로 설계	Photonics Conference 2018	Yong-Seok Hwan et al.
3	비대칭 집적영상 기법에서 동적 픽셀 매핑 기법을 이용한 부분적으로 가려진 3 차원 물체의 장애물 제거 방법	Photonics Conference 2018	Jae-Gwan Choi et al.
	광 시역 카메라 어레이를 이용한 증가된 시역을 갖는 프로젝션 집적 영상 시스템	Photonics Conference 2018	Hee-Min Choi et al.

• Year 2 (2019.03.-2020.02.)

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Group	Paper Name	Conference Name	Author
	Fiber reshaping-based refractive index sensor interrogated through both intensity and wavelength detection	제 26 회 광전자 및 광통신 학술회의	Peng Ji et al.
	Inline multi-channel optical power sensor in a muticore fiber based on direct femtosencond laser writing	Applied Optics and Photonics China 2019	Peng Ji et al.
	Nanophotonic devices based on dielectric metasurfaces	Optics and Photonics Congress 2019	Song Gao et al.
1	Nano-structural color filters incorporating an all- dielectric metasurface based on Si-rich silicon nitride	SPIE Optics +Photonics 2019	Chul–Soon Park et al.
	Multifunctional beam manipulation at telecommunication wavelengths enabled by all-dielectric metasurface doublet	Photonics Conference 2019	Changyi Zhou et al.
	가상이동 메타렌즈 어레이를 적용한 라이트 필드 이미징 시스템 해상도 개선	Photonics Conference 2019	Min-Kyu Park et al.
	Sub-micrometer-scale optical components based on femtosecond laser reduced graphene oxides	Photonics Conference 2019	Shiru Jiang et al.
	Flexible perfect absorber based on thin-film nanoresonator featuring a high-Q factor and a wide acceptance angle	Photonics Conference 2019	Chul–Soon Park et al.

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Group	Paper Name	Conference Name	Author
	Multi-step dewetting method for the fabrication of Pd- Au core shell nanostructures on sapphire (0001): Morphological and optical properties analysis	2019 Collaborative Conference on Materials Research	Sandesh Pant et al.
	Evolution of Pd–Ag Core–Shell nanostructures on sapphire (0001) via two–step solid stage dewetting method	2019 Collaborative Conference on Materials Research	Sanchaya Pandit et al.
	Light-mediated synthesis of urchin-like Ag nanostructures for enhanced SERS	2019 Collaborative Conference on Materials Research	Rahul Purbia et al.
	Synthesis of self-assembled Au, Ag, Pt monometallic and multi-metallic nanostructures on sapphire (0001): Morphological and plasmonic properties analysis	2019 Collaborative Conference on Materials Research	Puran Pandey et al.
	Dynamic plasmonic response of fully alloyed AgPt and pure Pt nanoparticles fabricated with the Ag/Pt bilayer	2019 Collaborative Conference on Materials Research	Sundar Kunwar et al.
	EEG detection and nerve stimulation system of wearable EEG headset communicated for neurodegenerative diseases	2019 대한퇴행성 신경 질환학회 학술대회	Zhi–Ji Wang et al.
2	Selective detection of DNA by the radio frequency biosensor based on microwave resonator using integrated passive device technology	8th Asia–Pacific Conference on Antennas and Propagation	Eun-Seong Kim et al.
	An L-band bandpass filter based on intertwined inductor and centered-located capacitor using integrated passive device technology	8th Asia–Pacific Conference on Antennas and Propagation	Bao-Hua Zhu et al.
	A micro-fabricated radio frequency biosensor based on microwave resonator using integrated passive device technology for selective detection of uric acid	8th Asia–Pacific Conference on Antennas and Propagation	Zhi-Ji Wang et al.
	The alteration of brain connectivity in frontal lobe epilepsy patients based on the alpha band analysis after vagal nerve stimulation	International Brain Research Organization 2019	Zhi-Ji Wang et al.
	Identification of epileptogenic zone based on network- connectivity analysis derived from the frequency spectrum of the recorded EEG	International Brain Research Organization 2019	Zhi–Ji Wang et al.
	Capacitive sandwich biosensor for oligomeric Aβ detection using Pt/Ti based interdigitated capacitor	3rd International Professors Workshop on Plasma Information Exchange 2019	Parshant Kumar Sharma et al.
	Realization of label-free PSA biosensor with highly- ordered metasurface nano-pore array using AAO template	1&2 Dimensional Material International Conference and Exhibition	Eun-Seong Kim et al.
	Low–cost highly–ordered nanopillar array on meta– surface for biosensing application	1&2 Dimensional Material International	Bao-Hua Zhu et al.







Group	Paper Name	Conference Name	Author
		Conference and Exhibition	
	Rotational-motion compensation algorithm for the real- time generation of the holographic videos of 3–D objects	2019 년도 한국통신학회 하계종합 학술발표회	Hong-Kun Cao et al.
3	볼륨 홀로그램 가상 현실 구현을 위한 균일 분포 정렬 광 생성 light guide plaet 시스템 설계	2019 년도 한국통신학회 추계종합 학술발표회	Yong–Seok Hwang et al.
	Fast generation of holographic videos based on full- scale 1-D NLUT with least memory capacity	2019 년도 한국통신학회 추계종합 학술발표회	Hong–Kun Cao et al.

• Year 3 (2020.03.-2021.02.)

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Group	Paper Name	Conference Name	Author
	Cat's eye retroreflector incorporating an ultrathin metasurface doublet	2020 한국광학회 하계학술발표회	Hongliang Li et al.
	Multi–functional beam manipulation enabled by an all– dielectric metasurface doublet	2020 한국광학회 하계학술발표회	Changyi Zhou et al.
	실리콘 나이트라이드 기반의 비주기 간격 광위상배열 연구	제 27 회 광전자 및 광통신 학술회의	Ji–Yeong Gwon et al.
	End–fire silicon nitride optical phased array providing adjustable beam divergence	제 27 회 광전자 및 광통신 학술회의	Chenxi Wang et al.
	무선 광통신 방향-분할 다중화를 위한 실리콘 나이트라이드 광위상배열	제 27 회 광전자 및 광통신 학술회의	Chul–Soon Im et al.
	Reflective color filters and broadband perfect absorbers based on a thin film nanocavity incorporating platinum	제 27 회 광전자 및 광통신 학술회의	Chul–Soon Park et al.
	End–fire silicon nitride optical phased array with a reduced vertical beam width	Photonics Conference 2020	Chenxi Wang et al.
1	Silicon nitride optical phased array based lens-free photonic receiver enabling direction-division demultiplexing for free-space communication	Photonics Conference 2020	Chul–Soon Im et al.
	Platinum incorporated Fabry–Perot nanocavity enabling highly efficient color filters and broadband perfect absorbers	Photonics Conference 2020	Chul–Soon Park et al.
	Gaussian beam shaping for optical phased array using a biconvex spherical–cylindrical lens	Photonics Conference 2020	Menglong Luo et al.
	Photothermally tunable diffraction gating based on reduced graphene oxide induced by femtosecond laser writing	Photonics Conference 2020	Shiru Jiang et al.
	Demonstration of gain-clamped-SOA with silicon nitride Bragg grating reflector	Photonics Conference 2020	Om Raj Sapkota et al.
	Ultrathin retroreflector incorporating a metasurface doublet at telecommunication wavelength	Photonics Conference 2020	Hongliang Li et al.
	Fiber–optic meta–tip enabling focused vortex and beam collimation	Photonics Conference 2020	Changyi Zhou et al.

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NDAC

왕운대학교 KwangWoon University VIII

Group	Paper Name	Conference Name	Author
2	Meta-surface AAO nanopore film coated with Ag n2anoparticles and protein complex material for localized surface plasmon resonance biosensor platform	2020년 한국전기 전자 재료학회	Bao-Hua Zhu et al.
	Meta-surface nanopillar platform using P[VDF-TrFE] coated with Ag and protein complex material for plasmon resonance biosensor application	2020년 한국전기 전자 재료학회	Bao-Hua Zhu et al.
	Meta-surface nanopore platform using AAO coated with Ag and protein for plasmonic biosensor application	2020년 한국 바이오칩학회 추계학술대회	Bao-Hua Zhu et al.
	Development of localized surface plasmon resonance biosensor platform using nanopillar metasurface and Ag+protein material	2020년 한국 바이오칩학회 추계학술대회	Bao-Hua Zhu et al.
	반사형 풀 칼라 고 대조비 VHOE 홀로글래스 디스플레이	2020년도 한국통신학회 하계종합 학술발표회	Yong-Seok Hwang et al.
	높은 광 효율가지는 핀홀기반 전 방향 라이트 필드 홀로그래픽 디스플레이	2020년도 한국통신학회 하계종합 학술발표회	Yong-Seok Hwang et al.
	반사형 풀 칼라 고 투명 VHOE 홀로글래스 디스플레이	2020년도 한국통신학회 하계종합 학술발표회	Yong-Seok Hwang et al.
	핀홀 기반 홀로그래픽 디스플레이의 광 효율 향상을 위한 수직 평행 빔 및 수렴 빔 어레이 생성하는 백라이트 시스템	제 27 회 광전자 및 광통신 학술회의	Yong-Seok Hwang et al.
3	비대칭 집적 영상 시스템의 픽업과 복원 과정의 광학적 특성	제 27 회 광전자 및 광통신 학술회의	Yong–Seok Hwang et al.
	Pinhole based table top light-field holographic display with high optical efficiency	The 11th International Conference on ICT Convergence	Yong-Seok Hwang et al.
	Computational holographic imaging based on volume holographic optical element for color dispersion free holographic virtual display	The 11th International Conference on ICT Convergence	Yong-Seok Hwang et al.
	Ion-migration induced degradation of perovskite light- emitting diodes	The 20th International Meeting on Information Display	Hyunho Lee et al.

2nd Phase Conferences Presentation

• Year 1 (2021.03.-2022.02.)

Group	Paper Name	Conference Name	Author
1	Reduced gratphene oxide incorporated Fresnel zone plate based on multi-step Fs-laser writing	Conference on Optoelectronics and Optical Communications 2021	Shiru Jiang et al.
	효율적인 빔조향을 위한 메타표면 더블렛이 집적된 양방향 격자 안테나	Conference on Optoelectronics and	Woo-Bin Lee et al.







Group	Paper Name	Conference Name	Author
		Optical Communications 2021	
	Near-infrared tunable metasurface holograms based on phase change material	Conference on Optoelectronics and Optical Communications 2021	Hongliang Li et al.
	All–dielectric meta–fiber for polarization–controlled bifunctional beam manipulation	Conference on Optoelectronics and Optical Communications 2021	Changyi Zhou et al.
	Metasurface doublet-based flat retroreflector for wireless optical communication	Optoelectronics and Communications Conference 2021	Hongliang Li et al.
	Bifunctional fiber meta-tip for polarization-selective optical interconnect	Optoelectronics and Communications Conference 2021	Changyi Zhou et al.
	Photothermally tunable diffraction grating based on ultra-thin reduced graphene oxide enabled by femtosecond laser	Optoelectronics and Communications Conference 2021	Shiru jiang et al.
	Aperiodic optical phased array incorporating cubic– Bézier–curve–shaped grating antenna channels	Optics and Photonics Congress 2021	Ji-Yeong Gwon et al.
	All-dielectric metasurface doublet enabling Gaussian to tophat beam shaping	Optics and Photonics Congress 2021	Jinke li et al.
	All-dielectric metasurface doublet enabling beam steering and polarizing beam splitting	META 2021	Changyi Zhou et al.
	Flexible and Transparent 2D TFTs for Active–Matrix Display	Korea–China Joint Seminar NANO DEVICES and ICT APPLICATIONS	Hamin Park et al.
	Direct growth of three-dimensional shaped 2D materials for sensing applications	Korea-China Joint Seminar NANO DEVICES and ICT APPLICATIONS	Su Han Kim et al.
	Flexible Narrowband and Broadband Perfect Absorbers Incorporating Fabry–Pérot Nanocavities	Korea–China Joint Seminar NANO DEVICES and ICT APPLICATIONS	Chul–Soon Park et al.
	All-dielectric meta-fiber for polarization-controlled bifunctional beam manipulation	Korea-China Joint Seminar NANO DEVICES and ICT APPLICATIONS	Changyi Zhou et al.
	Tunable metasurface holograms based on phase change material at near-infrared regime	Korea-China Joint Seminar NANO DEVICES and ICT APPLICATIONS	Hongliang Li et al.
	All–dielectric metasurface lens for Gaussian to tophat beam shaping (GTBS) in near–infrared region (1.55 um)	Korea-China Joint Seminar NANO DEVICES and ICT APPLICATIONS	Jinke Li et al.
	Convert the Gaussian beam into the top hat beam using a geometric lenses group	Korea–China Joint Seminar NANO DEVICES and ICT APPLICATIONS	Menglong Luo et al.







Group	Paper Name	Conference Name	Author
	Efficiency–enhanced Fresnel zone plate patterned on rGO by multi–step Fs–laser writing	Korea–China Joint Seminar NANO DEVICES and ICT APPLICATIONS	Shiru Jiang et al.
	Efficient beam steering via bidirectional grating antenna incorporating metasurface doublet	Korea–China Joint Seminar NANO DEVICES and ICT APPLICATIONS	Woo–Bin Lee et al.
	Compact switchable polarization beam splitter using phase change material incorporated silicon nitride waveguide	Korea–China Joint Seminar NANO DEVICES and ICT APPLICATIONS	Bishal Bhandari et al.
	Effective beam modification in optical fiber by longitudinal femtosecond laser writing	Asia Communications and Photonics Conference	Shiru jiang et al.
	Highly efficiency hybrid edge and grating coupler for full–scale wafer–level testing enabled by optical phase change material	Photonics Conference 2021	Bishal Bhandari et al.
	Optical phased array using lithium niobate—silicon nitride based electro–optic phase shifters	Photonics Conference 2021	Woo-Bin Lee et al.
	Top–hat beam shaping based on a combination of cylindrical, lenticular, and aspherical lenses	Photonics Conference 2021	Menglon Luo et al.
	Metasurface doublet-based flat telescope enabling polarization-controllable enhanced beam steering	Photonics Conference 2021	Hongliang Li et al.
	Ultraviolet Photodetector using hybrid PdAg plasmonic nanoparticles, graphene quantum dots and titanium dioxide	International Hazar Scientific Researches Conference – II	Shusen Lin et al.
	Non–enzymatic and super porous hybrid CuO/Pt NPs platform with the improved performance for the hydrogen peroxide detection	International Hazar Scientific Researches Conference – II	Rakesh Kulkarni et al.
	SERS enhancement of Rhodamine 6G by a mixture approach with graphene quantum dots on hybrid core-shell Pd@Ag NPs	International Hazar Scientific Researches Conference – II	Rutuja Mandavkar et al.
2	High–performance ultraviolet photodetector based on vertical hybrid structure: GQD, TiO2 and plasmonic PdAg nanoparticles	Al–Farabi International Congression Applied Sciences – II	Shusen Lin et al.
	Highly super porous and non–enzymatic hybrid CuO/Pt NPs platform with improved sensitivity and selectivity for the detection of hydrogen peroxide	Al–Farabi International Congression Applied Sciences – II	Rakesh Kulkarni et al.
	Development of SERS platform for the detection of Rhodamine 6G by utilizing graphene quantum dots on hybrid core-shell Pd@Ag NPs	Al–Farabi International Congression Applied Sciences – II	Rutuja Mandavkar et al.
	Hybrid GQD/Pd@Ag NPs nanostructured based SERS platform for the detection of Rhodamine 6G	Korea–China Joint Seminar Nano Devices and ICT Applications	Rutuja Mandavkar et al.
	Significantly enhanced performance of UV photodetector architecture utilizing GQD, TiO2 and plasmonic PdAg NPs	Korea-China Joint Seminar Nano Devices and ICT Applications	Shusen Lin et al.
	Enhanced sensitivity and selectivity of hybrid CuO/Pt NPs platform for the detection of hydrogen peroxide	Korea–China Joint Seminar Nano Devices and ICT Applications	Rakesh Kulkarni et al.





Group	Paper Name	Conference Name	Author
	Bi–functional CoP2/Pt/FTO hybrid electrocatalysts for the simultaneous hydrogen evolution and oxygen evolution	Korea–China Joint Seminar Nano Devices and ICT Applications	Jae-Hun Jeong et al.
	액체 금속을 이용한 3 차원 전극 기반 고감도 미세유체 검출기 제작	제 23 회 한국 MEMS 학술대회	Hyesoo Hwang et al.
	3 차원 스페로이드의 경제적 생산을 위한 액적 기반 미세유체시스템 개발	제 23 회 한국 MEMS 학술대회	Jaehun Lee et al.
	Magnetic gradient isolation of CD44 antibody– mediated heterogenic cancer cells using microfluidic system	31st Anniversary World Congress on Biosensors	Jaehun Lee et al.
	Development of droplet based microfluidic system for fabricating 3D tumor spheroids	31st Anniversary World Congress on Biosensors	Jaehun Lee et al.
	Microfluidics: A new approach towards microalgae study	2021 한국환경생물학회 40 주년기념 정기학술대회	Byeolnim Oh et al.
	고민감도 마이크로 검출 시스템 구현을 위한 3 차원 전극 제작법 개발	2021 마이크로나노 시스템학회 추계 학술대회 및 정기총회	Hyun Soo Kim et al.
	Microfluidic platforms for biomanufacturing applications	International Biomedical Engineering Conference 2021	Hyun Soo Kim et al.
	Fabrication of high sensitivity 3D electrode for microfluidic detector using liquid metal	2021 년 한국 바이오칩 학회 추계학술대회	Byeolnim Oh et al.
	High-throughput microfluidic systems for cell and organoid analysis	Korea–China Joint Seminar NANO DEVICES and ICT APPLICATIONS	Hyun Soo Kim
	Label–Free AAO based nanopore metasurface optical platform for interferometric biosensing applications	Korea–China Joint Seminar NANO DEVICES and ICT APPLICATIONS	Sachin Mishra et al.
	Localized surface plasmon resonance biosensor platform using AAO membrane functionlized with silver nanoparticles	Korea–China Joint Seminar NANO DEVICES and ICT APPLICATIONS	Bao-Hua Zhu et al.
	Ultra–sensitive and reusable graphene oxide–modified double interdigitated capacitive (DIDC) sensing chip for detecting SARS–CoV–2	BIOSENSORS 2021 ONLINE 31st AWCB	Parshant Kumar Sharma et al.
	Humidity Sensing Properties of TiO /PVDF Nanocomposite Based on the Interdigitated Electrode	7th NANO TODAY CONFERENCE	Enkhzaya Ganbold et al.
	The effect of Mg-doped ZnO on the InP quantum dot light-emitting diodes	Korea-China Joint Seminar Nano Devices and ICT Applications	Dongbeom Heo et al.
3	Wavelength dependent light induced degradation of inverted perovskite solar cells	Korea–China Joint Seminar Nano Devices and ICT Applications	BeomHee Yoon et al.
	Analysis on the radiative recombination dynamics of quantum dot light–emitting diodes	Korea-China Joint Seminar Nano Devices and ICT Applications	Hyunho Lee et al.





Group	Paper Name	Conference Name	Author
	Wavelength dependent light induced degradation of inverted perovskite solar cells	The 21st International Meeting on Information Display	BeomHee Yoon et al.
	The effect of Mg–doped ZnO on the InP quantum dot light–emitting diodes	The 21st International Meeting on Information Display	Dongbeom Heo et al.
	3D 화상통신을 위한 비대칭 집적영상에서 깊이감 천이 방법을 통한 디지털 픽업	2021 년도 한국통신학회 하계 종합할술발표회	Yong Seok Hwang et al.
	Rigorous computational analysis of a doublet full–color see–through holographic mixed–reality display	Korea–China Joint Seminar NANO DEVICES and ICT APPLICATIONS	Yong Seok Hwang et al.
	Full–color High Transparent VHOE HoloGlass Digital Signage Display for Al Holo–Avatar	ICUFN 2021(The 12th International Conference on Ubiquitous and Future Networks)	Yong Seok Hwang et al.
	집적영상에서 디스플레이 픽셀 크기를 고려한 깊이감에 대한 기하학적 분석	2021 년도 한국 통신학회 추계 종합학술발표회	Yong Seok Hwang et al.
	이중 볼륨 홀로그램 광학소자를 이용한 확장 현실을 위한 색 분산 보상된 홀로그래픽 이미징	2021 년도 한국 통신학회 추계 종합학술발표회	Yong Seok Hwang et al.

• Year 2 (2022.03-)

VIII

Group	Paper Name	Conference Name	Author
1	Delay line design for wavelength tuned line scanning optical phased array	제 29 회 광전자 및 광통신 학술회의	Bishal Bhandari et al.
I	Single vortex-pair beam generator based on an all- dielectric metasurface	제29 회 광전자 및 광통신 학술회의	Hongliang Li et al.
	Hybrid MoS2/ZnO/HNPs based UV–photodectors for ultrahigh responsitivty and enhanced photocarrier injection	8th International Conference on Innovative Scientific Research	Rakesh Kulkarni et al.
2	Hybrid platform for significant SERS enhancement of methylene blue by adopting core–shell PtAu NPs and 2D MoS2 nanoplatelets	8th International Conference on Innovative Scientific Research	Shusen Lin et al.
	Hybrid structure of a mixed layer of MoS2 nanoflakes and ZnO quantum dots on plasmonic AuPd NPs for UV photodetector application	8th International Conference on Innovative Scientific Research	Shusen Lin et al.
	Unique hybrid architecture of MoS2/AuPt core-shell NPs for dual step CV SERS enhancement	8th International Conference on Innovative Scientific Research	Md Ahasan Habib et al.
	ZnO QDs and MoS2 NPs mixture on the hybrid PdAu NP template for the enhanced photocurrent by the significant photocarrier generation	8th International Conference on Innovative Scientific Research	Rutuja Mandavkar et al.
	Differentiation between healthy elders, mild cognitive impairment, and Alzheimer's disease patients using virtual reality-based graph theory analysis with EEG	KSBNS Inspiring the Future Through Neuroscience	Zhi Ji Wang et al.



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Group	Paper Name	Conference Name	Author
	High–definition transcranial direct current stimulation in the ventrolateral prefrontal cortex modulates the sustained attention in virtual reality	KSBNS Inspiring the Future Through Neuroscience	Shan Yang et al.
	Detection of R6G biomolecular dye by utilizing the graphene quantum dots on the hybrid core-shell Pd@Ag NPs	4th International Scientific Research Conference	Shalmali Burse et al.
	Development of an ultrasensitive biosensor based on the highly porous Pt/CuO/Pt hybrid electrode	4th International Scientific Research Conference	Rutuja Mandavkar et al.
	Development of functionalized MoS2/AuPt core-shell NPs for SERS enhancement biomolecule detection via the incorporation of CV	4th International Scientific Research Conference	Md Ahasan Habib et al.
	MoS2 nanoplatelets on hybrid core-shell AuPt nanoparticles for the surface-enhanced Raman spectroscopy (SERS) enhancement of methylene blue	4th International Scientific Research Conference	Shusen Lin et al.
	Non-enzymatic super porous hybrid CuO/Pt NPs platform for detection of hydrogen peroxide (H2O2) and various other bio-molecules	4th International Scientific Research Conference	Rakesh Kulkarni et al.
	3D Electrode Based Microfluidic Platform for Microbial Growth Analysis	The Korean Society for Microbiology and Biotechnology 2022	Byeolnim Oh et al.
	AAO–assisted large–yield AgNP array for localized surface plasmon resonance biosensor application	Korea Nanotechnology Research Society(KoNTRS)	Bao-Hua Zhu et al.
	Sponge-like nanoporous P(VDF-TrFE)/LiCl composite platform for real-time humidity sensing	AMERICAN INSTITUTE OF SCIENCES	Enkhzaya Ganbold et al.

Patents

VIII

1st Phase Patent

Year 1 (2018.03.-2019.02.)

Group	Patent Name	Publication /Application Number	Inventor
1	실리콘–리튬나이오베이트 포토닉스 기반의 광 도파관 및 이를 이용한 초미세 광위상변조기	10-2019-0007525	Sang-Shin Lee
	광 굴절계 및 이를 구비한 실시간 모니터링 분석 장치	PCT-KR2019-002074	Sang-Shin Lee
2	스핀코팅(spin coating)을 이용한 산화아연 pH 센서 제조방법 및 이로부터 제조된 pH 센서	10-2019-0023593	Jae-Hyuk Ahn
	전자빔 증착(e-beam evaporation)을 이용한 산화알루미늄 pH 센서 제조방법 및 이로부터 제조된 pH 센서	10-2019-0023590	Jae-Hyuk Ahn



• Year 2 (2019.03-2020.02)

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Group	Patent Name	Publication /Application Number	Inventor
	편광과 포커싱 제어가 가능한 반파장판 메타표면, 메타렌즈 및 이들의 제조방법	10-2019-0007525	Sang-Shin Lee
	멀티코어 광섬유의 광 트래픽을 모니터링 하기 위한 다 채널 광 파워 모니터, 이를 포함하는 멀티코어 광섬유 및 다 채널 광 파워 모니터를 제작하기 위한 펨토초 레이저 쓰기 시스템	PCT-KR2019-002074	Sang-Shin Lee
1	초고속 레이저 각인에 의한 굴절률 재구성방법, 이를 이용한 광 전파 모드 제어 방법 및 외부매체의 광섬유 굴절률 감지 센서	10-2019-0023593	Sang-Shin Lee
	편향과 편광 튜닝된 포커싱 조절이 가능한 두 기능 유전체 메타표면 소자	10-2019-0023590	Sang-Shin Lee
	편광과 포커싱 제어가 가능한 반파장판 메타표면, 메타렌즈 및 이들의 제조방법	10-2019-0179512	Sang-Shin Lee
	리튬나이오베이트-실리콘나이트라이드 기반의 광 위상변조기 및 이를 이용한 광위상 배열안테나	10-2019-0042647	Sang-Shin Lee
	선형 편광에 대한 편광 선택적 메타표면을 이용한 트리포시 메타렌즈 소자	10-2019-0051341	Sang-Shin Lee
	고체 상태의 인듐-백금(In-Pt) 이중 층에 대한 디웨팅을 통하여 백금 나노 입자를 구성하는 방법	10-2019-0063418	Jihoon Lee
	희생 인듐 층을 사용하여 백금 나노 구조를 생성하는 방법	10-2019-0179512	Jihoon Lee
	채혈없이 소변내 글루코스 농도를 측정하는 RF 바이오센서와 그 제조 방법	10-2070349	Nam-Young Kim
2	에어로졸 증착 공정에 의한 초 민감도 습도 감지 필름 제조 방법	10-2020-0024413	Nam-Young Kim
	투명 안테나 및 그 제조 방법	10-2019-0085878	Nam-Young Kim
	더블 게이트 올 어라운드 구조의 나노트랜지스터 제조방법, 이로부터 제조된 나노트랜지스터 및 이를 이용한 익스텐디드 게이트(extended-gate) 구조의 센서	10-2019-0090377	Jae-Hyuk Ahn

Year 3 (2020.03.-2021.02.)

Group	Patent Name	Publication /Application Number	Inventor
1	실리콘–리튬나이오베이트 포토닉스 기반의 광 도파관 및 이를 이용한 초미세 광위상변조기	10-2116287	Sang-Shin Lee
	편향 또는 포커싱 조절이 가능한 두 기능 유전체 메타표면 소자	10-2143535	Sang-Shin Lee





Group	Patent Name	Publication /Application Number	Inventor
	무선 광통신 방향 분할 역다중화가 가능한 포토닉 위상배열 기반 수신기	10-2020-0130310	Sang-Shin Lee
	초고속 레이저 각인에 의한 굴절률 재구성방법, 이를 이용한 광 전파 모드 제어 방법 및 외부매체의 광섬유 굴절률 감지 센서 10-2173059 멀티코어 광섬유의 광 트래픽을 모니터링 하기 위한 다 채널 광 파워 모니터, 이를 포함하는 멀티코어 광섬유 		Sang-Shin Lee
			Sang-Shin Lee
			Sang-Shin Lee
	통신파장에서 다기능 빔 조작이 가능한 유전체 메타표면 더블렛 장치	10-2021-0012201	Sang-Shin Lee

2nd Phase Patent

• Year 1 (2021.03.-2022.02.)

Group	Patent Name	Publication /Application Number	Inventor
	편광과 포커싱 제어가 가능한 반파장판 메타표면, 메타렌즈 및 이들의 제조방법	10-2262913	Sang-Shin Lee
	소용돌이빔 및 시준빔 생성이 가능한 유전체 메타표면 기반의 광섬유 메타팁 장치	10-2021-0077678	Sang-Shin Lee
	선형 편광에 대한 편광 선택적 메타표면을 이용한 트리포시 메타렌즈 소자	10-2292826	Sang-Shin Lee
1	무선 광토인 방향 분할 역다중화가 가능한 포토닉 위상배열 기반 수신기	10-2329109	Sang-Shin Lee
I	메타표면 더블렛 기반의 평면 역반사기 장치 및 이를 이용한 자유공간 광통신 링크 방법	10-2021-0161595	Sang-Shin Lee
	메타표면 더블렛이 집적된 양방향 격자 안테나 및 이를 이용한 빔조향기	10-2021-0162029	Sang-Shin Lee
	기능화된 육방정계 질화 붕소 기반의 전하 저장층을 가지는 메모리 소자	10-2021-0114826	Hamin Park
	불순물 확산 방지 및 수평 열 방출이 용이한 층간막이 형성된 반도체 소자	10-2021-0121277	Hamin Park
2	플라즈모닉 하이브리드 나노입자, 이산화티타늄 및 그래핀 양자점을 포함하는 UV 광검출기 용 기판 및 이를 이용하는 UV 광검출기	10-2021-0046050	Jihoon Lee
	하이브리드 플라즈모닉 나노구조체 기반 페로브스카이트 광검출기 및 이의 제조방법	10-2021-0046049	Jihoon Lee







Group	Patent Name	Publication /Application Number	Inventor
	코발트 인화물을 포함하는 산소 및 수소 발생 반응용 이중기능성 전기화학적 촉매용 나노구조체 및 이의 제조방법	10-2021-0067256	Jihoon Lee
	코발트 인화물 및 백금을 포함하는 산소 및 수소 발생 반응용 이중기능성 전기화학적 촉매, 및 이를 포함하는 기판	10-2021-0067253	Jihoon Lee
	희생 인듐 층을 사용하여 백금 나노 구조를 생성하는 방법	10-2278221	Jihoon Lee
	은-금-백금 합금 나노입자의 제조방법	10-2318432	Jihoon Lee
	은-백금 합금 나노입자의 제조방법	10-2318428	Jihoon Lee
	플라즈모닉 하이브리드 나노입자, ZnO 양자점 및 전이금속 디칼코계니드를 포함하는 UV 광검출기용 기판 및 이를 이용하는 UV 광검출기	10-2021-0183122	Jihoon Lee
	반사형 풀 칼라 고 대조비 VHOE 홀로글래스 디스플레이	10-2021-0042730	Eun-Soo Kim
3	높은 광 효율을 갖는 핀홀 기반의 전방향 라이트 필드 홀로그래픽 디스플레이	10-2021-0042729	Eun-Soo Kim
	유기 태양전지의 전자수송층 도핑에 따른 열 안정성을 분석하는 방법	10-2021-0066691	Hyunho Lee

• Year 2 (2022.03-)

VIII

Group	Patent Name	Publication /Application Number	Inventor
1	편광제어로 향상된 빔 조향을 가능케 하는 유전체 메타표현 더블렛 장치	10-2022-0046798	Sang-Shin Lee
2	3 차원 전극 기반 미세유체 측정장치 및 그 제조방법	10-2022-0039362	Hyun Soo Kim
3	페브로스카이트 층을 포함하는 트랜지스터 소자의 특성 복원방법	10-2396951	Hyunho Lee
	8-히드록시퀴놀리놀레이토-리튬 전자추출층을 포함하는 페로브스카이트 태양전지 및 그 제조방법	10-2022-0060760	Hyunho Lee

Technology Transfer

1st Phase (2018.03.-2021.02.)

Year	Technology	Company	P.I
2018	Holographic 광학계 고도화 기술 연구_HOE 스크린 개발" 과제의 Kick-off 미팅	SK 텔레콤	Eun-Soo Kim
2019	실시간 산업 용액 품질 관리를 위한 고신뢰성 굴절 농동계 기술 개발	엑스빔테크㈜	Sang-Shin Lee





VIII

Year	Technology	Company	P.I
	실시간 산업 용액 품질 관리를 위한 고신뢰성 굴절 농동계 기술 개발	엑스빔테크㈜	Sang-Shin Lee
	실시간 산업 용액 품질 관리를 위한 고신뢰성 굴절 농동계 기술 개발	엑스빔테크㈜	Sang-Shin Lee
	나노 기술 및 ICT 융합 기술 지도를 통한 기술 경쟁력 확보하고 신산업 창출	㈜에스엔솔루션-신규사업부	Nam-Young Kim
	VHOE 기반 홀로 글래스 이용한 combiner type HUD 개발	현대모비스	Eun-Soo Kim
	VHOE 삽입된 자동차 Windshield 유리의 복곡면 저온 합착 공정 기술 가능성 문의	유진 디스컴 ㈜	Eun-Soo Kim
	센터 연구개발 기술을 이용한 홀로그램 induction 개발 산학협력 과제 협의	웅진코웨이	Eun-Soo Kim
	VHOE 기반 홀로 글래스 이용한 combiner type HUD 개발 2	현대모비스	Eun-Soo Kim
	카카오 투자사_홀로스페이스_사업및 광운대학교 센터 R&D 협력미팅	Kakao investment / SH investement / Holo Space	Eun-Soo Kim
	VHOE 기반 대형 홀로 글래스 대량생산에 대한 공정 협력에 관한 미팅	㈜ 미래나노텍	Eun-Soo Kim
	실시간 산업 용액 품질 관리를 위한 고신뢰성 굴절 농동계 기술 개발	엑스빔테크㈜	Sang-Shin Lee
	산업용액 모니터링용 광센서 기술 지도	엑스빔테크(주)	Sang-Shin Lee
	산업용액 모니터링용 광센서 기술 지도	엑스빔테크㈜	Sang-Shin Lee
	감시정찰용 모듈의 핵심 부품인 초고속 광변조기 기술 개발	LIG 넥스원	Sang-Shin Lee
	산업용액 모니터링용 광센서 기술 지도	엑스빔테크(주)	Sang-Shin Lee
	산업용액 모니터링용 광센서 기술 지도	엑스빔테크(주)	Sang-Shin Lee
	산업용액 모니터링용 광센서 기술 지도	엑스빔테크(주)	Sang-Shin Lee
	실시간 산업 용액 품질 관리를 위한 고신뢰성 굴절 농동계 기술 개발	엑스빔테크㈜	Sang-Shin Lee
2020	Fabrication of Au network by low-degree solid state dewetting	College of Materials Science and Engineering, Qingdao University	Jihoon Lee
	Enhanced Spatial Light Confinement of All Inorganic Perovskite Photodetectors Based on Hybrid Plasmonic Nanostructures	Wuhan university of technology	Jihoon Lee
	GaN (0001)상의 제어 가능한 팔라듐 나노 구조의 합성 및 광학 특성화	Beijing Institute of Technology	Jihoon Lee
	SERS enhancement of Rhodamine 6G by a unique mixture approach with graphene quantum dots	동국대학교	Jihoon Lee
	양자점 발광다이오드 효율/안정성 연구 최신동향, 양자점 발광다이오드의 열화 메커니즘	부산대학교	Hyunho Lee
	무기 기능층 적용 고효율 장수명 양자점 발광다이오드 개발	경상대학교	Hyunho Lee

교육부 Ministry of Education

NRF 한국연구재단

¹ 2nd Phase (2021.03-)

NDAC

광운대학교 KwangWoon University VIII

Year	Technology	Company	P.I
	신재생 발전량 예측 및 발전제한 방안	서울과학기술대학교	Hyunho Lee
	반도체 공정 및 양자점 발광다이오드 설계	부산대학교	Hyunho Lee
	양자점발광다이오드 최신 연구동향	성균관대학교	Hyunho Lee
	VHOE 기반 완전 투명 홀로글라스 디스플레이	지엘디(주)	Eun-Soo Kim
	VHOE 기반 투과형 완전 투명 홀로글라스 디스플레이	현대모비스(주)	Eun-Soo Kim
	핀홀 어레이 필름 기반 집적영상 공간 디스플레이	파슬리컴퍼니(주)	Eun-Soo Kim
	VHOE 기반 투과형 완전 투명 홀로글라스 디스플레이	더마솔루션(주)	Eun-Soo Kim
2021	VHOE 기반 투과형 완전 투명 홀로글라스 디스플레이	큐비콤(주)	Eun-Soo Kim
	VHOE 기반 투과형 완전 투명 홀로글라스 디스플레이	청운개발(주)	Eun-Soo Kim
	VHOE 기반 투과형 완전 투명 홀로글라스 디스플레이	삼진(주)	Eun-Soo Kim
	VHOE 기반 투과형 완전 투명 홀로글라스 디스플레이	조은기술단(주)	Eun-Soo Kim
	VHOE 기반 투과형 완전 투명 홀로글라스 디스플레이	삼성디스플레이(주)	Eun-Soo Kim
	SARS-CoV-2 의 현장 진단을 위한 재활용 가능한 신속 DNA 바이오센서 기술	지나인제약(주)	Nam-Young Kim
	상완 관절과 손목 관절의 재활을 포함하는 상지 재활 로봇	하이드로봇테크앤리서치㈜	Hyun Soo Kim
2022	자문컨설팅계약(Al 기반 회로 및 Layout 최적화)	삼성전자(주)	Hanwool Jeong

Research Grant Funding

Project Title	Support Organization	Total Research Grant (1,000 ₩)	P.I
RF 나노 수동집적회로(IPD) 공정기술의 RF 공진기 구현 및 바이오 센서 응용 연구(4 차년도)	한국연구재단	33,333	Nam-Young Kim
전자기파를 이용한 매설배관 탐지 및 가스누출탐지 기술에 관련 이론적 근거 지원 및 특허 출원 및 논문 아이디어 제공	(주)케이피디글로벌	44,000	Nam-Young Kim
The Flexible Electronics-한중 신진 과학자 교류사업(초빙)	한국연구재단	31,000	Nam-Young Kim
전자기파를 이용한 배관탐지장치 국산화 기술개발(1/3)	중소벤처기업부	22,000	Nam-Young Kim
홀로디지로그 휴먼미디어 연구센터	한국연구재단	11,059,275	Eun-Soo Kim
지능형 의료 플랫폼 개발	한국연구재단		Eun-Soo Kim
천연색소 생산 미생물 탐색 및 배양 최적화를 위한 미세유체 스크리닝 시스템 개발(1/2)	한국생명공학 연구원	190,000	Hyun Soo Kim
신규 고부가가치 환경시료 미생물 자원 발굴 및 유용성 검증을 위한 고성능 미세유체 스크리닝 시스템 개발	한국연구재단	141,022	Hyun Soo Kim





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Project Title	Support Organization	Total Research Grant (1,000 ₩)	P.I
2021 년도 BRIDGE+ 사업 실용화 개발 지원 과제(연세대)	한국연구재단	33,000	Chulhwan Park, Hyun Soo Kim
비등방적 플라즈모닉 공진 현상 기반 R/G/B 풀컬러 구조색 구현 전기가변 메타 광 소자 개발	한국연구재단	30,000	Min-Kyu Park
플렉서블 나노 광학 소자 공정 기술 개발	국가나노인프라 협의체	13,330	Chul-Soon Park
나노 메타표면 및 광 집적 소자를 이용한 하이브리드 광학 디바이스 공정 기술 개발	국가나노인프라 협의체	12,990	Chul-Soon Park
2 차원 소재 기반의 게이트 스택을 이용한 유연한 고신뢰성 메모리 원천기술 연구	한국연구재단	123,066	Hamin Park
센서산업 고도화를 위한 첨단센서 인력양성사업	한국산업기술 진흥원	147,120	Jae-Hyuk Ahn
고성능 바이러스 검출용 메타나노포어 바이오센서 개발	국가나노인프라 협의체	8,770	Jae-Hyuk Ahn
미처리 혈청 내 바이오마커 검출을 위한 광전자 스위치 바이오센서 개발(1 차년도)		37,500	Jae-Hyuk Ahn
초고속 빔포밍을 위한 메타표면 더블렛이 집적된 전기광학 위상배열 칩 및 이를 적용한 무선광통신 모듈	과학기술 정보통신부	1,100	Sang-Shin Lee
3 차원 나노구조체를 가지는 2D 물질을 이용한 박막형 고성능 광전소자 개발 및 응용	국가나노인프라협의체	13,700	Sang-Shin Lee
나노-마이크로 구조 기반 광/전자소자 및 6G 응용연구 핵심인력양성	한국연구재단	113,570	Sang-Shin Lee, Hyunho Lee
차세대 하이브리드 플라즈모닉 나노구조물 (HP- NA) 기반 포토디텍터 구현/최적화	과학기술 정보통신부	436,942	Jihoon Lee
다기능 양자점 자외선 다운 컨버팅층을 도입한 장수명 페로브스카이트 태양전지(2 차년도)	한국연구재단	50,000	Hyunho Lee
전하 주입 최적화를 통한 고효율 장수명 친환경 양자점 발광다이오드 개발	국가나노인프라 협의체	4,550	Hyunho Lee
나노 메타표면을 적용한 고효율 장수명 페로브스카이트 발광다이오드 개발	국가나노인프라 협의체	7,850	Hyunho Lee
전면발광 고효율 장수명 양자점 발광다이오드 개발 및 이를 이용한 인공지능기반 수명 평가 시스템 개발	한국연구재단	160,135	Hyunho Lee
고효율 고순도 수소 생산을 위한 Super-Porous Hybrid 나노구조 촉매 개발	한국연구재단	87,500	Jae-Hun Jeong
IEEE802.15.4z 규격을 호환하는 차량용 UWB 칩 개발	한국산업기술평가관리원	435,580	Yun Seong Eo





교육부 Ministry of Educat



NDAC Seminars



*Online

2022.06.24. (26th) *Online



No.	Date	Presenter (affiliation)	Title	
1	2018.08.04.	Prof. Duk–Yong Choi (Australian National University)	Colour filter research	
2	2018.09.20.	Prof. Young Min Song (GIST)	Recent advances in unusual optical coatings for flexible device applications	
3	2018.10.15.	Prof. Gyoujin Cho (Sunchon University)	R2R gravure for the fabrication of large area flexible displays and inexpensive NFC sensor tags	
4	2018.12.20.	Prof. Sang-Hyun Oh (Minnesota University)	Plasmonic nanogap devices for biosensing and spectroscopy applications	
5	2019.01.07.	Prof. Kyu–Tae Lee (Inha University)	Nanostructures for color generation, decorative solar cells and broadband absorbers	
6	2019.02.18.	Prof. Junsuk Rho (POSTECH)	Metamaterials for extreme control and manipulation of light	
7	2019.03.27.	Prof. Tony Low (Minnesota University)	Manipulating light flow with 2D materials plasmons	



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IX

No.	Date	Presenter (affiliation)	Title	
8	2019.04.26.	Prof. Bumki Min (KAIST)	Time-variant metasurfaces for linear frequency conversion	
9	2019.06.26.	Dr. Jin Tae Kim (ETRI)	Optoelectronic Devices based on low– dimensional nanomaterials	
10	2019.06.26.	Prof. Yang H. Yun (University of Akron)	The development of bioinspired polymers for nanomedicine	
11	2019.10.23.	Prof. Kyoungsik Yu (KAIST)	Silicon–based optoelectronic devices for communication and sensing applications	
12	2019.12.18.	Dr. Hak–Sun Lee (SK Telecom)	Laser display technology of SK Telecom	
13	2021.03.13.	Prof. Lee Pooi See (Nanyang Technological University)	Deformable electronics and energy devices for human–machine interface	
14	2021.06.03.	Dr. Sung-Hoon Hong (ETRI)	Metamaterial technology based on nanocrystal	
15	2021.06.17.	Prof. Jeonghun Kwak (Seoul National University)	Colloidal quantum dot based light emitting diodes for displays and lighting devices	
16	2021.07.15.	Prof. Gwanho Yoon (Seoul University of Science and Technology)	Low cost scalable manufacturing of dielectric metasurfaces	
17	2021.09.09.	Prof. Young–Ik Sohn (KAIST)	Chip–scale engineering for quantum computation and communication	
18	2021.10.06.	Prof. Min-Kyo Seo (KAIST)	High–Q/V LiNbO3 optical micro–resonators for scalable nonclassical photon generation	
19	2021.11.10.	Prof. Chul Gyu Jhun (Hoseo University)	Encapsulated liquid crystals and its applications	
20	2021.11.24.	Dr. Seung-Heon Baek (KIST)	Current and future prospect of MRAM technology in semiconductor industry	
21	2021.12.15.	Prof. Won II Park (HANYANG University)	3D InGaN/GaN light–emitting crystal arrays for multi–color emission and dynamic wavelength change to pressure	
22	2022.04.29.	Prof. Bongjun Kim (SOOKMYUNG Women's University)	Thin–Film transistors and circuits based on inkjet printed semiconductors	
23	2022.05.06.	Prof. II–Sug Chung (UNIST)	Silicon on–chip optoelectronic devices and their applications	
24	2022.05.27.	Prof. Hyunkoo Lee (SOOKMYUNG Women's University)	OLED technology for metaverse	
25	2022.06.10.	Dr. Chan-mo Kang (ETRI)	Display technology for virtual and augmented reality	
26	2022.06.24.	Prof. Chiwan Koo (HANBAT University)	Femto-second laser based micromachining for glass microfluidic chips	
27	2022.07.15.	Dr. II–Joo Cho (KIST)	Wireless Microsystems for Recording Neural Signals with Various Stimulations	
28	2022.08.05.	Prof. Woong Choi (SOOKMYUNG Women's University)	Deep Learning Accelerator based on In– Memory–Computing	



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IX

2021 KOREA-CHINA Joint Seminar (Nano Devices and ICT Application)



Time	Title	Name (Affiliation)
14:00~14:10	Welcome speech (General Co-Chair)	Prof. Sang-Shin Lee, Kwangwoon University
14:10~14:20	Welcome speech (General Co-Chair)	Prof. Wenjing Yue, University of Jinan
	Session 1: Nano Materials, Devices, and Fabrication (Chair : Prof. Hyunho	Lee)
14:20~14:50	IT-1: Materials and Fabrication of Nano-photonic Devices	Prof. Duk-Yong Choi, Australian National University
14:50~15:05	S1-1: Flexible Narrowband and Broadband Perfect Absorbers Incorporating Fabry-Pérot Nanocavities	Dr. Chul-Soon Park, Nano Device Application Center
15:05~15:20	S1-2: Nanostructural color filtering device exploiting amorphous hydrogenated silicon metasurface	Prof. Wenjing Yue, University of Jinan
15:20~15:30	Coffee Break	
15:30~15:45	S1-3: Bi-functional CoP ₂ /Pt/FTO hybrid electrocatalysts for the simultaneous hydrogen evolution and oxygen evolution	Dr. Jae-Hun Jeong, Nano Device Application Center
15:45~16:00	S1-4: Plasmonic Nanostructures Associated High Sensitivity ZnO Colloidal Quantum Dots UV Photodetectors	Prof. Ming-Yu Li, Wuhan University of Technology
16:00~16:15	S1-5: Direct growth of three-dimensional shaped 2D materials for sensing applications	Dr. Su Han Kim, Nano Device Application Center
16:15~16:30	S1-6: Flexible and Transparent 2D TFTs for Active-Matrix Display	Prof. Hamin Park, Kwangwoon University
16:30~16:40	Coffee Break	
16:40~16:55	S1-7: High-throughput microfluidic systems for cell and organoid analysis	Prof. Hyun Soo Kim, Kwangwoon University
16:55~17:10	S1-8: AAO-assisted non-lithographic large-scale fabrication	Prof. Zhao Yao, Qingdao University
17:10~17:25	S1-9: Label-Free AAO based nanopore metasurface optical platform for interferometric biosensing applications	Dr. Sachin Mishra, Nano Device

Time	Title	Name (Afiiliation)
	P1-1: Localized surface plasmon resonance biosensor platform using AAO membrane functionlized with silver nanoparticles	Bao-Hua Zhu, Kwangwoon University
	P1-2: All-dielectric meta-fiber for polarization-controlled bifunctional beam manipulation	Changyi Zhou, Kwangwoon University
	P1-3: Cotton_rGO_CNT structured wearable pressure sensor with high waterproofness and breathability	Feifei Yin, University of Jinan
	P1-4: Tunable metasurface holograms based on phase change material at near-infrared regime	Hongliang Li, Kwangwoon university
	P1-5: Triboelectric and interfacial iontronic tactile sensor based on bionic skin structure for intelligent tactile perception system	Hongsen Niu, University of Jinan
Student Poster	P1-6: All-dielectric metasurface lens for Gaussian to tophat beam shaping (GTBS) in near-infrared region (1.55 µm)	JinKe Li, Kwangwon University
Session 1: Nano Materials, Devices and	P1-7: Convert the Gaussian beam into the top hat beam using a geometric lenses group	Menglong Luo, Kwangwoon University
Fabrication	P1-8: Multifunctional optoelectronic RRAM device based on surface- plasma-treated inorganic halide perovskite	Qi Liu, University of Jinan
	P1-9: Enhanced sensitivity and selectivity of hybrid CuO/Pt NPs platform for the detection of hydrogen peroxide	Rakesh Kulkarni, Kwangwoon University
	P1-10: Hybrid GQD/Pd@Ag NPs nanostructured based SERS platform for the detection of Rhodamine 6G	Rutuja Mandavkar, Kwangwoon University
	P1-11: Efficiency-enhanced Fresnel zone plate patterned on rGO by multi step Fs-laser writing	Shiru Jiang, Kwangwoon University
	P1-12: Significantly enhanced performance of UV photodetector architecture utilizing GQD, TiO ₂ and plasmonic PdAg NPs	Shusen Lin, Kwangwoon University
	P1-13: Efficient beam steering via bidirectional grating antenna incorporating metasurface doublet	Woo-Bin Lee, Kwangwoon University
	P2-1: Wavelength dependent light induced degradation of inverted perovskite solar cells	BeomHee Yoon, Kwangwoon University
Student Poster Session 2:	P2-2: The effect of Mg-doped ZnO on the InP quantum dot light-emitting diodes	Dongbeom Heo, Kwangwoon University
CT Applications of Nano Devices	P2-3: Artificial Optoelectronic Synapses based on TiN ₄ O ₂₋₄ /MoS ₂ Heterojunction for Neuromorphic Computing and Visual System	Wenxiao Wang, University of Jinan
	P2-4: Flexible Interactive Integrated Device for Pressure Perception and Visualization	Yunjian Guo, University of Jinan

NDAC Seminars

	Title
	P1-1: Localized surface plasmon resonance biosensor membrane functionlized with silver nanoparticles
	P1-2: All-dielectric meta-fiber for polarization-controlle beam manipulation
	P1-3: Cotton_rGO_CNT structured wearable pressure s waterproofness and breathability
	P1-4: Tunable metasurface holograms based on phase at near-infrared regime
	P1-5: Triboelectric and interfacial iontronic tactile sens skin structure for intelligent tactile perception system
	P1-6: All-dielectric metasurface lens for Gaussian to to (GTBS) in near-infrared region (1.55 μm)
	P1-7: Convert the Gaussian beam into the top hat bea lenses group
	P1-8: Multifunctional optoelectronic RRAM device bas plasma-treated inorganic halide perovskite
	P1-9: Enhanced sensitivity and selectivity of hybrid Cu the detection of hydrogen peroxide
	P1-10: Hybrid GQD/Pd@Ag NPs nanostructured based the detection of Rhodamine 6G
	P1-11: Efficiency-enhanced Fresnel zone plate patterne

Program

Time	Title	Name (Affiliation)
	Session 2: ICT Applications of Nano Devices (Chair : Prof. Ming-Yu L	i)
14:00~14:30	IT-2: Longwave infrared photodetectors and modulators combining nano-optics and 2D materials	Dr. Vivek Raj Shresth Quantum Brilliance
14:30~14:45	S2-1: Carbon Nanotube-Based Ion-Sensitive Field-Effect Transistors Toward Wearable Sodium Sensing	Prof. Jae-Hyuk Ahn Chungnam National University
14:45~15:00	S2-2: Microwave Detection of Grain Moisture Content Based on Patch Antennas	Prof. Jun-Ge Liang, Jiangnan University
15:00~15:10	Coffee Break	
15:10~15:25	S2-3: Flexible Smart Wearable System	Prof. Yang Li, University of Jinan
15:25~15:40	S2-4: Analysis on the Radiative Recombination Dynamics of Quantum Dot Light-Emitting Diodes	Prof. Hyunho Lee, Kwangwoon Universit
15:40~15:55	S2-5: Microwave-Based Optimized Interdigital Sensor for Full Characterization of Dielectric Materials	Prof. Cong Wang, Harbin Institute of Technology
15:55~16:05	Coffee Break	
16:05~16:20	S2-6: Resolution-improved light-field imaging utilizing virtual- moving metalens array	Dr. Min-Kyu Park, Korea Photonics Technology Institute
16:20~16:35	S2-7: Multidimensional control of full-space light with dielectric metasurfaces	Prof. Song Gao, University of Jinan
16:35~16:50	S2-8: Rigorous computational analysis of a doublet VHOE based full-color see-through holographic mixed-reality display	Dr. Yong Seok Hwan Nano Device Application Center
	Poster Presentation (web)	Student Session

Oral Presentation







Date: 07/02 (Eri)

교육부







Welcome speech





교육부

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Media Promotion

🗄 1 세부 (Materials and Devices)



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◘ 2 세부 (Bio / Healthcare)

朝鮮日報. 조선미디어그룹 로그인	
광운대학교 김남영 교수(전자공학과), 바이오센터 통한 코로나19 진단 가능 기술 개발	매일일보 HOME > 사회 > 교육 광운대 연구팀, 나노 메타표면 기반 QR코드 생성 기법 개발 용 최재원기자 @ 승인 2021.04.21 17:22
입력 2021.11.17 09:56 - 잠복기 환자약 무중상자 수준의 DNA 농도까지 분석 가능할 정도로 정확도 높아 -	고해상도의 정보 암호화, 위조 방지 등 기술에 활용 가능
VERITAS ^α ℍΟΜΕ > 대입 > 대입┿스 광운대 이지훈 교수 연구팀 바이러스 박테리아 초 기 탐지 가능한 포토디텍터 개발	상생의 시장경제를 지키는 브릿지경제 광운대 이지훈 교수팀, 페로브스카이트 기반 NUV 포토센서 소자 구현 ^{류용한 기자} 최종 기사입력 2020-11-26 13:48
() () () () () () () () () ()	VERITAS ^α HOME 대입 대학뉴스 광운대, 융복합 연구를 통한 차세대 고성능 습도 센서 개발

🗄 3 세부 (5G + New industry)



교육부

NRF 한국연구재단

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· 광운대학교 KwangWoon University XI

Memorandum of Understanding (MOU)

Research Collaboration, Exchange of Researchers, and Promotion of Joint Research Projects

No.	Year.Month	Nation	Institute
1	2019.01.	China	Qingdao University
2	2019.07.	China	Huazhong University of Science and Technology (HUST)
3	2019.06.	Australia	Australian National University
4	2019.07.	China	University of Jinan
5	2019.07.	China	University of Jinan
6	2019.08.	Korea	Korea Institute of Science and Technology
7	2019.12.	Japan	Osaka University
8	2019.08.	Korea	SKT
9	2019.09.	Korea	COWAY Co., Ltd.
10	2019.04.	Korea	Plasma Science Co., Ltd.
11	2019.04.	Korea	Mission Tech Co., Ltd.
12	2019.10.	Korea	Cellandbio Co., Ltd.
13	2020.11.	Korea	Hanyang University
14	2020.11.	Korea	Chungnam National University
15	2020.12.	USA	University of Illinois at Urbana-Champaign
16	2020.12.	Korea	PUSAN NATIONAL UNIVERSITY

Qingdao University	Huazhong University of Science and Technology (HUST)	Australian National University	University of Jinan
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IX



X Memorandum of Understanding (Mou)



University of Jinan	Korea Institute of Science and Technology	Osaka University	SK Telecom
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COWAY Co., Ltd.	Plasma Science Co., Ltd.	Mission Tech Co., Ltd.	Cellandbio Co., Ltd.
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NDAC Webpage

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Recruitment for Research Scientist

Post-doctor and alternative military service

1. Research field

Nanoscale Material & Device	Nanophotonic device (metamaterial, metasurface) Integrated photonic device (waveguide, silicon photonics) Nanodevice fabrication Graphene and 2D materials
Next-generation Nanodevice and ICT application	Meta hologram Flexible / wearable device Photodetector and image sensor Photovoltaic / light-emitting device

2. Requirement

- Post-Doctor: Ph.D. degree
- Alternative military service: M.S. degree
- (Preferred) Experience in industry or research institute

3. Payment

- Annual salary: ~45 million Korean won (4 insurances are included.) with incentives for achievement
- 4. Documents for submission: CV, certificate of degree
- 5. Contact: lms@kw.ac.kr, 02-909-3303





교육부

Edit Postscript

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This report contains history, research results, developments, events, and collaborations of NDAC. NDAC acknowledges to participating professors and researchers for their keen interest and significant contribution.

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Acknowledgement	This report is supported by Basic Science Research Program through the National Research Foundation of Korea (NRF) funded by the Ministry of Education (No. 2018R1A6A1A03025242)





