대회명

제 30회 한국반도체학술대회
The 30th Korean Conference on Semiconductors (KCS 2023)

일시

2023년 2월 13일(월) - 15일(수)

장소

강원도 하이원 리조트

규모

약 2,600명

주제

Semiconductor for a Sustainable Future

주관

SK 하이닉스 | KSIA 한국반도체산업협회 | COSAR 한국반도체연구조합

주최

KPS 한국물리학회 The Korean Physical Society | MRS KOREA 한국재료학회 | 대한전기학회 | IEIE 대한전자공학회
IDEC 반도체설계교육센터 IC DESIGN EDUCATION CENTER | ISE 반도체공학회 | 한국반도체디스플레이기술학회 The Korean Society of Semiconductor & Display Technology

후원

GWTO 강원도관광재단 Gangwon Tourism Organization | SK 하이닉스 | SAMSUNG | DB하이텍
Silicon Mitus | JUSUNG ENGINEERING | ASML | DONGJIN SEMICHEM CO.,LTD. | AUROS Technology
WONIK IPS | Lam RESEARCH | KLA | UniTest | APPLIED MATERIALS
TEL | DONGWOO FINE-CHEM | SYNOPSYS Silicon to Software | TechwidU Technology with you | Adaptive Plasma
NEXTIN | FST FINE SEMITECH CORP. | MiCo Family MiCo, MiCo Ceramics, KoMiCo | soulbrain | Lotvacuum
HANA MICRON | PSK | Telechips | ZEISS | semi | cadence

프로그램

- 기조강연
- 초청강연
- Short Course
- Rump Session
- 구두세션
- 포스터세션
- 기업체 전시
- 강대원상 시상식
- 만찬
- Chip Design Contest

문의

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2023년 2월 15일(수), 10:45-12:30
Room E (루비 II, 5층)

E. Compound Semiconductors 분과
[WE2-E] Compound Semiconductor II

좌장: 차호영 교수(홍익대학교)

WE2-E-1 **10:45-11:15** **[초청]**	**Near-Junction Thermal Management for High-Power Electronics** Jungwan Cho *School of Mechanical Engineering, Sungkyunkwan University*
WE2-E-2 **11:15-11:30**	**Impact of $Hf_xAl_{1-x}O$ Gate Dielectric in the Performance Enhancement of AlGaN/GaN High Electron Mobility Transistors** Ju-Won Shin[1], Walid Amir[1], Surajit Chakraborty[1], Atish Bhattacharjee[1], Hyo-Joung Kim[1], Jae-Moo Kim[2], and Tae-Woo Kim[1] *[1]School of Electrical, Electronic, and Computer Engineering, University of Ulsan, [2]KANC*
WE2-E-3 **11:30-11:45**	**Cryogenic Switches based on InGaAs HEMT for Quantum Signal Routing** Jaeyong Jeong[1], Seong Kwang Kim[1], Jongmin Kim[2], Jisung Lee[3], Joon Pyo Kim[1], Bong Ho Kim[1], Yoon-Je Suh[1], Dae-Myeong Geum[1], Seung-Young Park[3], and SangHyeon Kim[1] *[1]School of Electrical Engineering, KAIST, [2]KANC, [3]KBSI*
WE2-E-4 **11:45-12:00**	**$In_{0.53}Ga_{0.47}As$ MOS Interface Optimization Using Post Deposition Annealing and Post Metal Annealing for Photo-FET on Si Wafer** Sung-Han Jeon[1,2], Dae-Hwan Ahn[1], Jindong Song[1], Woo-Young Choi[2], and Jae-Hoon Han[1] *[1]Center for Opto-Electronic Materials and Devices, KIST, [2]Department of Electrical and Electronic Engineering, Yonsei University*
WE2-E-5 **12:00-12:15**	**Positive–Bias–Stress Instability Assessment of AlGaN/GaN HEMTs during On-State Condition** Walid Amir[1], Ju-Won Shin[1], Ki-Yong Shin[1], Surajit Chakraborty[1], Takuya Hoshi[2], Takuya Tsutsumi[2], Hiroki Sugiyama[2], Hideaki Matsuzaki[2], and Tae-Woo Kim[1] *[1]Department of Electrical, Electronic, and Computer Engineering, University of Ulsan, [2]NTT Device Technology Laboratories, NTT Corporation*
WE2-E-6 **12:15-12:30**	**Study of Delta-doping Dopants on GaAs Tunnel Junctions and Their Thermal Degradation toward High Efficiency III-V/Si Tandem Cell** May Angelu Madarang[1,2], Rafael Jumar Chu[1,2], Yeonhwa Kim[1,3], Eunkyo Ju[1], Quang Nhat Dang Lung[1,2], Tae Soo Kim[1,4], Won Jun Choi[1], and Daehwan Jung[1,2] *[1]Center for Opto-Electronic Materials and Devices, KIST, [2]Division of Nano and Information Technology, University of Science and Technology (UST), [3]Department of Materials Science and Engineering, Korea University, [4]School of Electrical and Electronic Engineering, Yonsei University*

$In_{0.53}Ga_{0.47}As$ MOS Interface Optimization Using Post Deposition Annealing and Post Metal Annealing for Photo-FET on Si Wafer

Sung-Han Jeon[1,2], Dae-Hwan Ahn[1], Jindong Song[1], Woo-Young Choi[2], Jae-Hoon Han[1]*

1Center for Opto-Electronic Materials and Devices, Korea Institute of Science and Technology (KIST), 2Department of Electrical and Electronic Engineering, Yonsei University, Korea

SWIR (Short-wave infrared) detectors are widely used in Si Photonics, medical devices, LiDAR sensors, and quantum computing. Especially, $In_{0.53}Ga_{0.47}As$ has been used to detect SWIR wavelengths due to lattice-matched InP wafer and high absorption coefficient. The PIN and APD structures are widely used in the $In_{0.53}Ga_{0.47}As$ photodetector. However, there are challenges in the detection of weak light since PIN does not provide any internal gain and APD suffers from the high operating voltage with a large excess noise [1]. To solve the aforementioned problems, Photo-FETs, which have middle internal gain and low operating voltage, have been researched. Recently, organic and 2D material-based Photo-FET structures have been widely studied, but these materials are unsuitable for the SWIR region due to low mobility [2].

In our previous research, $In_{0.53}Ga_{0.47}As$ based Photo-FET were fabricated by using wafer bonding technology, and optical properties with various device channel lengths were investigated. However, a decrease of I_{ph} was observed at the saturation voltage region. We have assumed that the $In_{0.53}Ga_{0.47}As$ interface and oxide trap led to a decrease of I_{ph}.

In this study, to optimize the optical properties of the Photo-FET, the $In_{0.53}Ga_{0.47}As$ MOS capacitor was fabricated and C-V curves are measured to evaluate the D_{it} and slow trap density. Figure 1 shows $In_{0.53}Ga_{0.47}As$ Photo-FET structure and cross-section. Figure 2 shows the C-V curves with post-deposition annealing (PDA) and post-metal annealing (PMA) conditions at 350 ºC for 10min. Figure 3 shows D_{it} at PDA and PMA in 350 ºC conditions calculated with the Terman method. This research proposes MOS interface condition optimized D_{it} and slow trap to evaluate the optical property of $In_{0.53}Ga_{0.47}As$ Photo-FET.

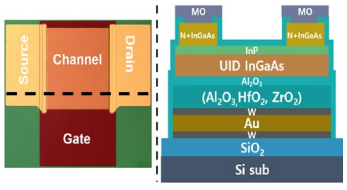

Fig.1 Photo-FET structure and cross-section

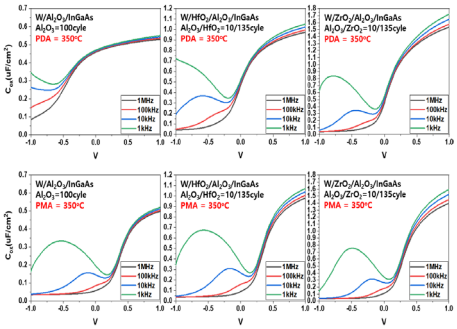

Fig.2 W/high-k/Al_2O_3/$In_{0.53}Ga_{0.47}As$ MOS capacitor with PMA and PDA C-V curve

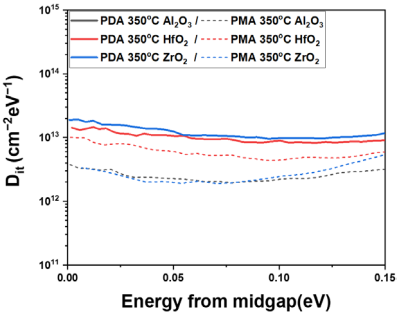

Fig.3 D_{it} of W/high-k/Al_2O_3/$In_{0.53}Ga_{0.47}As$ MOS capacitor

Acknowledgments This work was supported in part by the Institutional Program (2E31532) funded by KIST, and in part by the NRF (Grant No. NRF-2022M3F3A2A01085469 and NRF-2022R1C1C1007333), and the Institute of Information & Communications Technology Planning & Evaluation (IITP) grant funded by the Korea government (MSIT) (No. 2022-0-00208).

References [1] J.J.S. Huang et al., *"Temperature dependence study of mesa-type InGaAs/InAlAs avalanche photodiode characteristics," Advances in OptoElectronics 2017.* [2] F. H. L. Koppens et al., *"Photodetectors based on graphene, other two-dimensional materials and hybrid systems," Nat. Nanotechnol 2014.*