Website Information
Department of Physics
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Item	**Details**
Faculty Name:	**Dr. V. Janardhanam**
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Designation:	**Associate Professor**
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Research Area:	**Semiconductor Materials and Devices Characterization** **Wide and Ultrawide Bandgap Semiconductors** **Photodiodes, Schottky diodes, High-power Devices**
Publications (Past 5 Years)	**During: 2025** **1.** Fermi-level depinning of Ge surface using hydrogen plasma-immersion ion implantation **V. Janardhanam**, I. Jyothi, Sameer Pokhrel and Chel-Jong Choi ***Journal of Alloys and Compounds 1010 (2025) 177972.*** **Impact Factor: 5.8, Quartile: Q1, Citations: 0** 2. Microstructural and chemical properties of holmium oxide (Ho_2O_3) and its effect on electrical and current transport process of Au/n-GaN Schottky contact as an interlayer D. Surya Reddy, **V. Janardhanam**, V. Rajagopal Reddy and Chel-Jong Choi ***Vacuum 231 Part A (2025) 113780*** 3. Epilayer thickness effect on the electrical and breakdown characteristics of vertical β-Ga_2O_3 Schottky barrier diode Hyeon-Cheol Kim, **V. Janardhanam**, Sameer Pokhrel and Chel-Jong Choi ***Journal of Crystal Growth 649 (2025) 127941.*** 4. Photovoltaic and Barrier Properties of Au/n-Ge Schottky Junction Modified by Methylene Blue Organic Dye Interlayer D. Mallikarjuna, A. Ashok Kumar, V. Rajagopal Reddy, S. Kaleemulla, **V. Janardhanam** and Chel-Jong Choi ***Journal of Inorganic and Organometallic Polymers and Materials (Accepted).*** **During: 2024** 5. Digital etching of AlGaN/GaN heterostructures with GaN cap using inductively couple oxygen plasma process combined with wet chemical treatment Jong-Hee Kim, Hyeon-Cheol Kim, Hyeon-Yeong Jeong, **V. Janardhanam**, A. Ashok Kumar, V. Rajagopal Reddy and Chel-Jong Choi ***Materials Science in Semiconductor Processing 181 (2024) 2.***

Impact Factor: 4.2, Quartile: Q1, Citations: 0

6. Effect of inductively coupled plasma etch on the interface barrier behavior of (001) β-Ga_2O_3 Schottky barrier diode
   Hoon Ki Lee, **V. Janardhanam**, Woojin Chang, Kyujun Cho, Chel-Jong Choi and J.K. Mun
   Journal of Vacuum Science and Technology B 42 (2024) 042204.
   Impact Factor: 1.5, Quartile: Q3, Citations: 0

7. Enhancement of device performance in β-Ga_2O_3 Schottky barrier diodes with tetramethylammonium hydroxide treatment
   V. Janardhanam, Jong-Hee Kim, I. Jyothi, Hyun-Ho Jung, Seong-Jong Kim, Kyu-Hwan Shim and Chel-Jong Choi
   Colloids and surfaces A: Physicochemical and Engineering Aspects 693 (2024) 134079.
   Impact Factor: 4.9, Quartile: Q1, Citations: 0

8. Electrical, structural and photovoltaic properties of acceptor dye modified Au/n-Ge heterostructure
   D. Mallikarjuna, A. Ashok Kumar, S. Kaleemulla, V. Rajagopal Reddy, M. Raghavender, **V. Janardhanam** and Chel-Jong Choi
   Solid State Communications 386 (2024) 115523.
   Impact Factor: 2.1, Quartile: Q2, Citations: 1

9. Analysis of photodiode and barrier properties of CoPc/n-Ge heterojunction under various illumination wavelengths
   A. Ashok Kumar, **V. Janardhanam**, V. Rajagopal Reddy and Chel-Jong Choi
   Optik - International Journal for Light and Electron optics* 307 *(2024) 171811.
   Impact Factor: 3.1, Citations: 0

10. Microstructural evolution of Ni-stanogermanides and Sn segregation during interfacial reaction between Ni film and $Ge_{1-x}Sn_x$ epilayer grown on Si substrate
    Han-Soo Jang, Jong-Hee Kim, **V. Janardhanam**, Kyu-Hwan Shim and Chel-Jong Choi
    Crystals 14 (2024) 134.
    Impact Factor: 2.4, Quartile: Q2, Citations: 0

During: 2023

11. Carrier transport across $PtSe_2$/n-type GaN heterojunction
    V. Janardhanam, Jong-Hee Kim, I. Jyothi, Min-Sung Kang, Sang-Kwon Lee and Chel-Jong Choi
    Vacuum 218 (2023) 112597.
    Impact Factor: 3.8, Quartile: Q1, Citations: 4

12. Self-powered MoS_2/n-type GaN heterojunction photodetector with

broad spectral response in ultraviolet–visible–near-infrared range
V. Janardhanam, M. Zummukhorol, I. Jyothi, Kyu-Hwan Shim and Chel-Jong Choi
Sensors and Actuators A: Physical* 360 *(2023) 114534.
Impact Factor: 4.1, Quartile: Q1, Citations: 8

13. Modification of interface properties of Au/n-GaN Schottky junction by rare-earth oxide Nd_2O_3 as an interlayer and its microstructural characterization
D. Surya Reddy, **V. Janardhanam**, V. Rajagopal Reddy and Chel-Jong Choi
Vacuum 215 (2023) 112300.
Impact Factor: 3.8, Quartile: Q1, Citations: 7

14. Temperature-dependent Schottky diode behavior of Ni Schottky contacts to α-Ga_2O_3 film epitaxially grown on sapphire substrate
Sosorburam Boldbaatar, **V. Janardhanam**, Munkhsaikhan Zumuukhorol, Hoon-Ki Lee, Hae-Yong Lee, Hyo Jung Kim, Kyu-Hwan Shim and Chel-Jong Choi
Materials Science in Semiconductor Processing 163 (2023) 107589.
Impact Factor: 4.2, Quartile: Q1, Citations: 6

15. Correlation of crystal defects with device performance of AlGaN/GaN high electron mobility transistors fabricated on silicon and sapphire substrates
Sakhone Pharkphoumy, **Vallivedu Janardhanam**, Tae-Hoon Jang, Kyu-Hwan Shim and Chel-Jong Choi
Electronics 12 (2023) 1049.
Impact Factor: 2.6, Quartile: Q2, Citations: 6

16. Broadband photodetector based on MoS_2/Ge heterojunction for optoelectronic applications
M. Zumuukhorol, Z. Khurelbaatar, Dong-Ho Kim, Kyu-Hwan Shim, **V. Janardhanam**, V. Rajagopal Reddy and Chel-Jong Choi
Vacuum 209 (2023) 111746.
Impact Factor: 3.8, Quartile: Q1, Citations: 16

During: 2022

17. Rapid-thermal-annealing-induced microstructural evolution of Au/Ni/β-Ga_2O_3 Schottky diodes correlated with their electrical properties
V. Janardhanam, Sosorburam Boldbaatar, I. Jyothi, Dong-Ho Kim, Kyu-Hwan Shim and Chel-Jong Choi
Journal of Alloys and Compounds 918 (2022) 165622.
Impact Factor: 5.8, Quartile: Q1, Citations: 7

During: 2021

8. Optimized device geometry of normally-on field-plate AlGaN/GaN

high electron mobility transistors for high breakdown performance using TCAD simulation
Sakhone Pharkphoumy, **Vallivedu Janardhanam,** Tae-Hoon Jang, Kyu-Hwan Shim and Chel-Jong Choi
Electronics 10 (2021) 2642.
Impact Factor: 2.6, Quartile: Q2, Citations: 6

19. Effects of rapid thermal annealing on the structural, optical and electrical properties of Au/CuPc/n-Si (MPS)-type Schottky barrier diodes
P.R. Sekhar Reddy, **V. Janardhanam,** V. Rajagopal Reddy, Min Hyuk Park and Chel-Jong Choi
Applied Physics A : Materials Science and Processing 127 (2021) 803.
Impact Factor: 2.5, Quartile: Q2, Citations: 12

20. High gain GaN ultraviolet Schottky photodetector with Al-doped ZnO interlayer
V. Janardhanam, I. Jyothi, M. Zumuukhorol, Shim-Hoon Yuk, Kyu-Hwan Shim and Chel-Jong Choi
Surfaces and Interfaces 27 (2021) 101405.
Impact Factor: 5.7, Quartile: Q1, Citations: 15

21. Temperature-dependent interface barrier behavior in MoS$_2$/n-GaN 2D/3D heterojunction
V. Janardhanam, I. Jyothi, Shim-Hoon Yuk, M. Zumuukhorol and Chel-Jong Choi
Materials Letters 296 (2021) 129893.
Impact Factor: 2.7, Quartile: Q1, Citations: 8

22. Microstructural and phase evolutions of Pt Contact to N-type In$_{0.53}$Ga$_{0.47}$As Driven by Rapid Thermal Annealing and Its Correlation with Specific Contact Resistivity
Shim-Hoon Yuk, **V. Janardhanam,** Kyu-Hwan Shim and Chel-Jong Choi
Intermetallics 133 (2021) 107178.
Impact Factor: 4.3, Quartile: Q1, Citations: 0

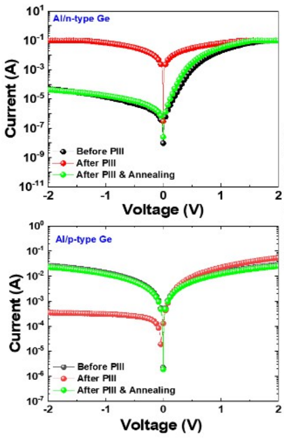
23. Electrical and carrier transport properties of Ti/α-amylase/p-InP MPS junction with a α-amylase enzyme interlayer
C. Venkata Prasad, **V. Janardhanam,** Chel-Jong Choi and V. Rajagopal Reddy
Journal of Materials Science: Materials in Electronics 32 (2021) 8092-8105.
Impact Factor: 2.8, Quartile: Q2, Citations: 21

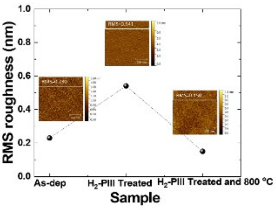
During: 2020

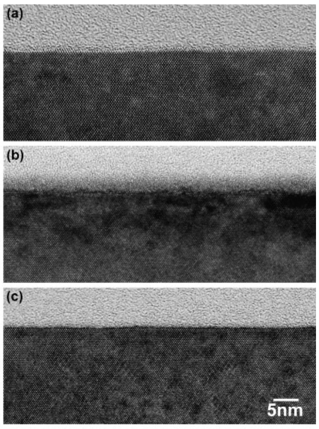
24. Temperature-dependent Schottky barrier properties of Al/n-type Si Schottky barrier diode with Au–CuPc nanocomposite interlayer

	P. Sekhar Reddy, **V. Janardhanam,** Kyu-Hwan Shim, Sung-Nam Lee, A. Ashok Kumar, V. Rajagopal Reddy and Chel-Jong Choi ***Thin Solid Films 713 (2020) 138343.*** **Impact Factor: 2.0, Quartile: Q2, Citations: 14** 25. Carrier conduction mechanisms of WSe$_2$/p-type Ge epilayer heterojunction depending on the measurement temperature and applied bias **V. Janardhanam,** I. Jyothi, Yonghun Kim, Sung-Nam Lee, Hyung-Joong Yun, Woong-Ki Hong and Chel-Jong Choi ***Journal of Alloys and Compounds 842 (2020) 155843***. **Impact Factor: 5.8, Quartile: Q1, Citations: 15** 26. Investigation of microstructural and electrical properties of self-aligned Ni-InGaAs alloy contacts to InGaAs as a function of rapid thermal annealing temperature Shim-Hoon Yuk, Hyun-Gwon Park, **V. Janardhanam,** Kyu-Hwan Shim, Sung-Nam Lee and Chel-Jong Choi ***Journal of ceramic processing Research 21 (2020) s53-s57***. **Impact Factor: 1.4, Quartile: Q3, Citations: 1** 27. Temperature dependent Schottky barrier parameters of Ni/Au on n-type (001) β-Ga$_2$O$_3$ Schottky barrier diode P. Sekhar Reddy, **V. Janardhanam,** Kyu-Hwan Shim, V. Rajagopal Reddy, Sung-Nam Lee and Chel-Jong Choi ***Vacuum 171 (2020) 109012.*** **Impact Factor: 3.8, Quartile: Q1, Citations: 78** 28. Schottky barrier parameters and low-frequency noise characteristics of Au/Ni contact to n-type b-Ga$_2$O$_3$ P. Sekhar Reddy, **V. Janardhanam,** Hoon-Ki Lee, Kyu-Hwan Shim, Sung-Nam Lee, V. Rajagopal Reddy and Chel-Jong Choi ***Journal of Electronic Materials 49 (2020) 297-305.*** **Impact Factor: 2.2, Quartile: Q2, Citations: 16**
Sponsored Projects (Past and Ongoing)	-------
Profile Links: Scopus, Orcid and Google Scholar	Scopus ID: ID : 23477275000, Orcid ID: https://orcid.org/0000-0001-7852-1496 https://scholar.google.co.in/citations?user=jh7e6DYAAAAJ&hl=en
Research Activities (Write about your best research results max of 2-3 pages including diagrams)	**1. Fermi-level depinning of Ge surface using hydrogen plasma-immersion ion implantation** Hydrogen plasma immersion ion implantation (PIII) has been demonstrated for alleviating Fermi-level pinning in Al/Ge junctions. The Al metal contacts with n- and p-type Ge without hydrogen PIII treatment displayed Schottky and ohmic behavior despite their low metal work functions, which can usually be ascribed to the strong Fermi-level pinning mechanism. The Al contact to the hydrogen PIII treated n- and p-type Ge,

however, displayed ohmic and Schottky behavior having barrier heights of 0.01 and 0.41 eV, respectively. This signifies Fermi-level unpinning in Al/Ge junctions. Hydrogen PIII treatment of Ge led to the creation of a 3-nm-thick amorphous Ge (a-Ge) layer at the surface, followed by a 9-nm-thick damaged layer. Annealing the PIII-treated Al/Ge contact at 800 °C resulted in a current level similar to that of the untreated contact. This could be ascribed to the recovery of PIII-induced surface damage through recrystallization of the a-Ge layer. The results of this study provide an approach for effective Fermi-level unpinning in metal/Ge junctions, which could be advantageous for the design of Ge-based devices with improved performance.

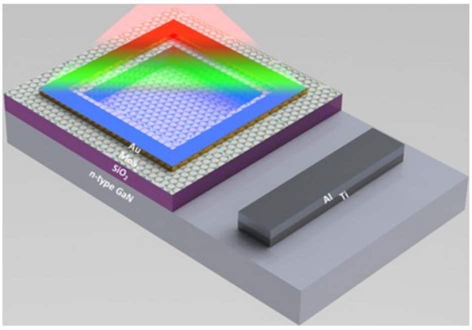


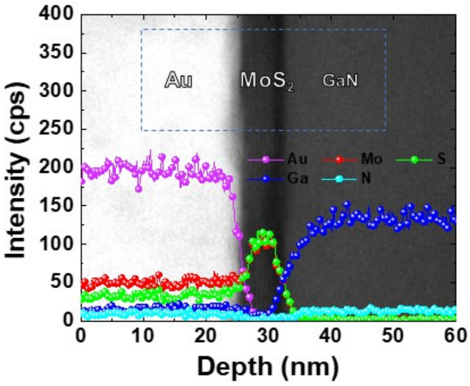


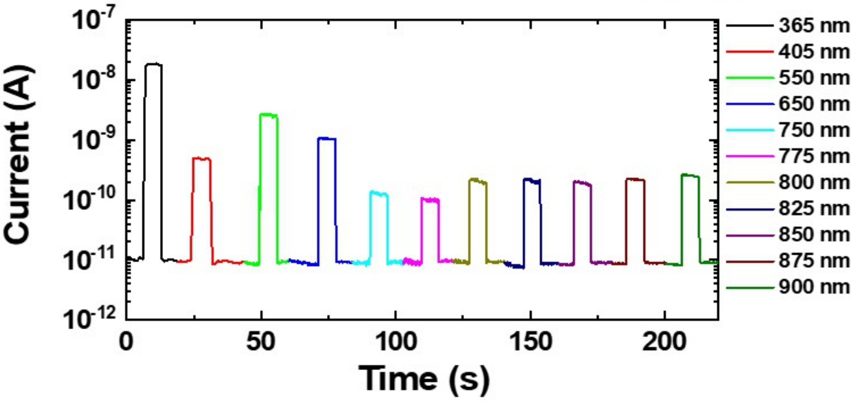


2. Self-powered MoS2/n-type GaN heterojunction photodetector with broad spectral response in ultraviolet–visible–near-infrared range

An MoS_2/n-type GaN 2-dimensional (2D)/3-dimensional (3D) hybrid heterojunction photodiode was fabricated by layer transfer of a large-scale grown MoS_2 film on a GaN substrate. The MoS_2/n-type GaN heterojunction photodiode was highly sensitive to ultraviolet (UV) light with a responsivity of 1.28×10^{6} and 28.18 AW^{-1} under the illumination of incident light with a wavelength of 365 nm at a forward and reverse voltage of ±3 V, respectively. The detectivity and noise-equivalent power of the photodiode were determined to be, respectively, 9.08×10^{14} $cm\cdot Hz^{1/2}\cdot W^{-1}$ and 5.50×10^{5} $pW\cdot Hz^{-1/2}$ at 365 nm and 3 V bias with a rise/fall duration of 98/ 144 ms. Moreover, the photodiode exhibited a self-powered operation with pronounced photoresponse at zero bias having a responsivity of 0.05 AW^{-1} at 365 nm. The MoS_2/n-type GaN heterojunction photodiode operated with outstanding stability and repeatability, spanning a wide wavelength range of the UV–near-infrared range, and exhibited a responsivity of 3.81, 0.73, and 0.09 AW^{-1} at 550, 750, and 900 nm, respectively. The mechanism of carrier transport in MoS_2/n-type GaN photodiodes was thoroughly explained using energy band diagrams. This self-powered photodetector, with superior light harvesting and good photoresponse over a wide wavelength range of the UV–near-infrared regime and carrier transport behavior, is anticipated to open up a window for integration of 2D-layered transition-metal dichalcogenides/GaN heterojunction-based multiple-wavelength photodetectors.

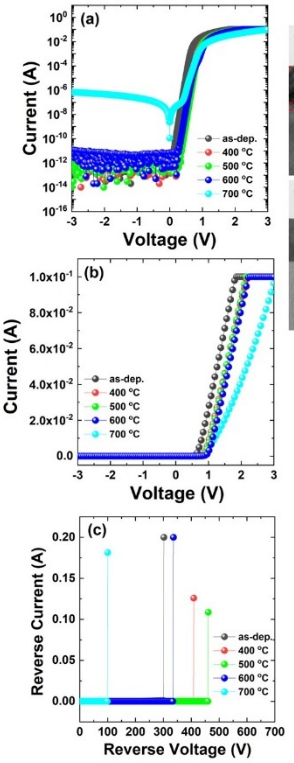
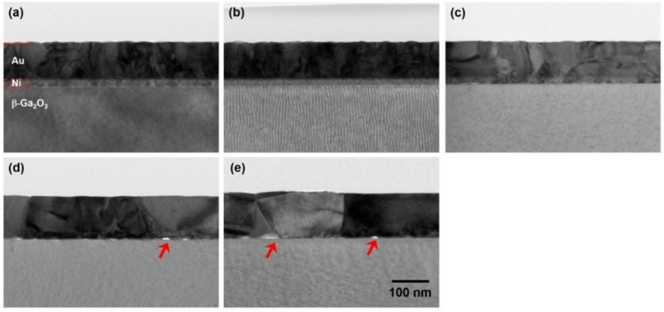
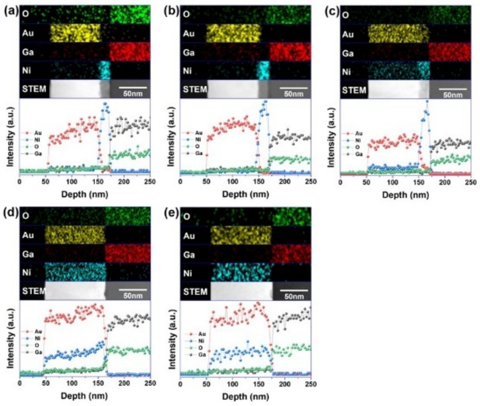






3. Rapid-thermal-annealing-induced microstructural evolution of Au/Ni/β-Ga2O3 Schottky diodes correlated with their electrical properties

This study investigated the rapid thermal annealing (RTA)-induced phase and microstructural evolution of Au/Ni/β-Ga2O3 Schottky diodes to demonstrate their effect on the diodes' electrical properties in the temperature range of 400–700 °C. Annealing at 500 °C led to a reaction between the Au and Ni films, forming Au-rich Au3Ni and Ni-rich AuNi3 phases along with a homogeneous AuNi alloy phase with a smooth surface and interface morphology. Only the Au2Ni phase formed after RTA at temperatures above 600 °C. Reactions did not occur between the Ni/Au metal contacts and the Ga2O3 substrate, regardless of the RTA temperature. The Au/Ni/β-Ga2O3 Schottky diode annealed at 500 °C exhibited improved rectifying behavior with a large barrier height (1.22 eV) and large breakdown voltage (Vbr) of 460 V, which may be associated with the formation of Au-Ni alloy films with a smooth surface morphology and abrupt interface with the Ga2O3 substrate. The Schottky diode behavior began to degrade upon RTA at 600 °C, which is attributed to the initiation of degradation of the surface and interface morphology of the Au2Ni alloy film. The deterioration of the Schottky behavior with the drastic increase of the reverse leakage current and sharp drop of Vbr upon RTA at 700 °C is attributed to the severe deterioration of the interface and surface morphologies, such as the roughened surfaces caused by agglomeration and void formation with the grain boundaries serving as high leakage current paths.

	  
Collaborations	Semiconductor Physics Research Center, Jeonbuk National University, South Korea, National Physical Laboratory, Sri Venkateswara University, Yogi Vemana University,
Open Positions	**One Ph.D. position is open**