

Website Information
Department of Physics
Dayananda Sagar University

Faculty details:

Item	Details
Faculty Name:	Dr. V. Janardhanam
Room No:	A-229
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
Patent	1. Beta gallium oxide Schottky barrier diode and method of preparing the same, Patent No. KR 10-2024-0131798 (Korea Patent Office), 2024
List of Publications	International Journals : 114 National Journals : 01 Books (Monograph) : 02 Conference Proceedings : 04
Invited Talks/Conferences/FDPs Attended	International : 35 National : 13 Invited Talks : 03 FDPs Attended : 05
Publications (Past 5 Years)	During: 2026 1. Mo-Induced Phase Stabilization and Enhanced Ferroelectric Performance of $\text{Hf}_{0.5}\text{Zr}_{0.5}\text{O}_2$ Thin Films for Non-Volatile Memory Applications P.R. Sekhar Reddy, V. Janardhanam Journal of Materials Science: Materials in Electronics (Accepted) 2. Study and optimization of the p-type $\text{Cu}_2\text{O}/\beta\text{-Ga}_2\text{O}_3$ P-N heterojunction power diode via TCAD simulation Hyeon-Cheol Kim, Sameer Pokhrel, V. Janardhanam and Chel-Jong Choi Journal of Semiconductor Technology and Science (Accepted). 3. Development of Pt-decorated rGO/SnO ₂ /PPy quaternary hybrids for rapid and highly sensitive acetone detection R. Triveni, Manikandan Dhamodaran, V. Janardhanam , Y. Srilatha, Vijaya Kumar Kambila Journal of Materials Science: Materials in Electronics 37 (2026) 1605.

	4. Surface, Interface Characterization and current transport Analysis of ZnPc/n-Ge Organic-Inorganic Heterojunction Photodiode S. Guruswathi, S. Ramesh, A. Ashok kumar, V. Janardhanam Journal of Electronic Materials 55 (2026) 977-990. During: 2025 5. Temperature Dependent Current Conduction Properties and Barrier Inhomogeneity of Au/Methylene Blue (MB)/n-Ge Heterostructure D. Mallikarjuna, A. Ashok Kumar V. Janardhanam, V. Rajagopal Reddy Journal of Materials Science: Materials in Electronics 36 (2025) 659. 6. Enhancement of device performance in vertical Au/Ni/β-Ga₂O₃ Schottky barrier diodes using regularly aligned inner field plates Hoon Ki Lee, Vallivedu Janardhanam, Jae Kyoung Mun, Tae-Hoon Jang, Kyu-Hwan, Shim, Hyung Joong Yun, Jonghan Won and Chel-Jong Choi Materials Science in Semiconductor Processing 191 (2025) 109371. 7. 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. 8. Microstructural and chemical properties of holmium oxide (Ho₂O₃) 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. 9. Epilayer thickness effect on the electrical and breakdown characteristics of vertical β-Ga₂O₃ Schottky barrier diode Hyeon-Cheol Kim, V. Janardhanam, Sameer Pokhrel and Chel-Jong Choi Journal of Crystal Growth 649 (2025) 127941. 10. 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 11. Digital etching of AlGaN/GaN heterostructures with GaN cap using inductively couple oxygen plasma process combined with wet chemical treatment
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	Jong-Hee Kim, Hyeon-Cheol Kim, Hyeon-Yeong Jeong, V. Janardhanam, A. Ashok Kumar, V. Rajagopal Reddy and Chel-Jong Choi <i>Materials Science in Semiconductor Processing</i> 181 (2024) 2. 12. Effect of inductively coupled plasma etch on the interface barrier behavior of (001) β-Ga₂O₃ Schottky barrier diode Hoon Ki Lee, V. Janardhanam, Woojin Chang, Kyujun Cho, Chel-Jong Choi and J.K. Mun <i>Journal of Vacuum Science and Technology B</i> 42 (2024) 042204. 13. Enhancement of device performance in β-Ga₂O₃ 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 <i>Colloids and surfaces A: Physicochemical and Engineering Aspects</i> 693 (2024) 134079. 14. 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 <i>Solid State Communications</i> 386 (2024) 115523. 15. 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 <i>Optik - International Journal for Light and Electron optics</i> 307 (2024) 171811. 16. Microstructural evolution of Ni-stannogermanides 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 <i>Crystals</i> 14 (2024) 134. During: 2023 17. Carrier transport across PtSe₂/n-type GaN heterojunction V. Janardhanam, Jong-Hee Kim, I. Jyothi, Min-Sung Kang, Sang-Kwon Lee and Chel-Jong Choi <i>Vacuum</i> 218 (2023) 112597. 18. Self-powered MoS₂/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 <i>Sensors and Actuators A: Physical</i> 360 (2023) 114534.
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19. Modification of interface properties of Au/n-GaN Schottky junction by rare-earth oxide Nd₂O₃ as an interlayer and its microstructural characterization
D. Surya Reddy, **V. Janardhanam**, V. Rajagopal Reddy and Chel-Jong Choi
Vacuum 215 (2023) 112300.
20. Temperature-dependent Schottky diode behavior of Ni Schottky contacts to α -Ga₂O₃ 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.
21. Correlation of crystal defects with device performance of AlGa_N/Ga_N 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.
22. Broadband photodetector based on MoS₂/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.

During: 2022

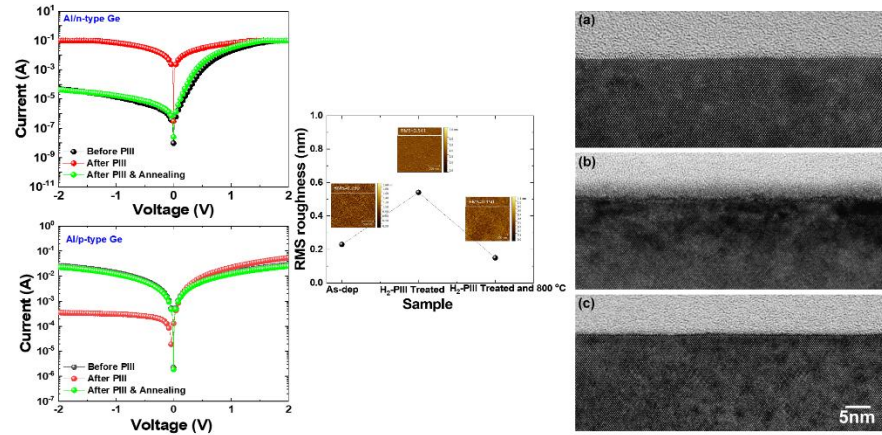
23. Rapid-thermal-annealing-induced microstructural evolution of Au/Ni/ β -Ga₂O₃ Schottky diodes correlated with their electrical properties
V. Janardhanam, Sosorburam Boldbaatar, I. Jyothi, Dong-Ho Kim, Kyu-Hwan Shim and Chel-Jong Choi
Journal of Alloys and Compounds 918 (2022) 165622.

During: 2021

24. Optimized device geometry of normally-on field-plate AlGa_N/Ga_N 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.
25. Effects of rapid thermal annealing on the structural, optical and electrical properties of Au/CuPc/n-Si (MPS)-type Schottky barrier diodes

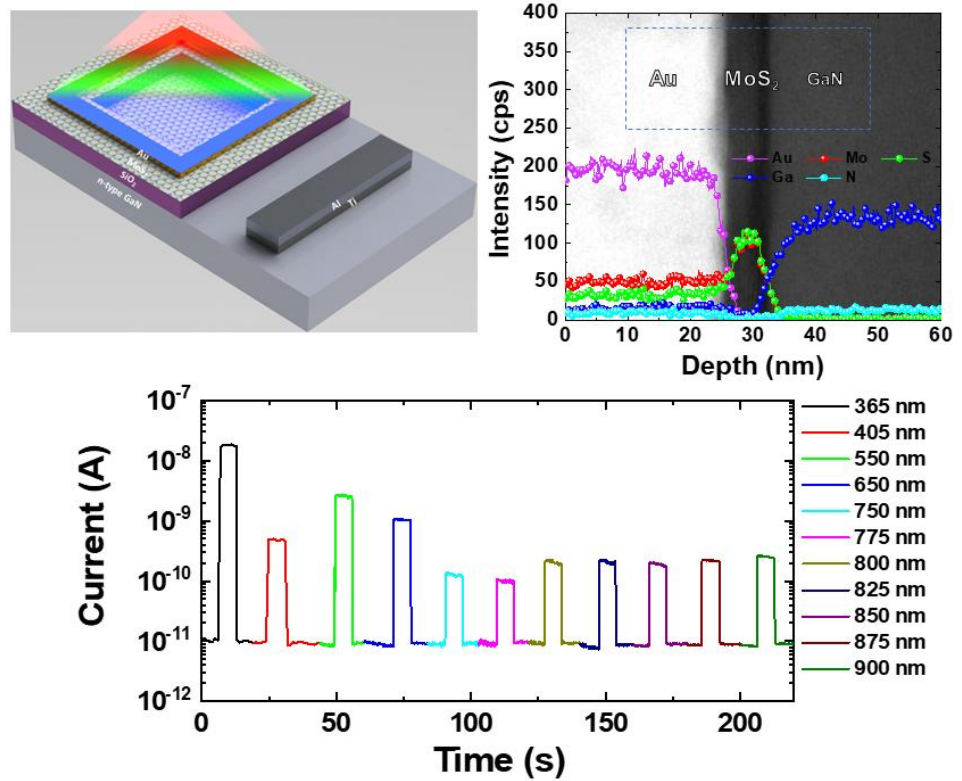
	P.R. Sekhar Reddy, V. Janardhanam, V. Rajagopal Reddy, Min Hyuk Park and Chel-Jong Choi <i>Applied Physics A : Materials Science and Processing</i> 127 (2021) 803. 26. High gain GaN ultraviolet Schottky photodetector with Al-doped ZnO interlayer V. Janardhanam, I. Jyothi, M. Zumuukhorol, Shim-Hoon Yuk, Kyu-Hwan Shim and Chel-Jong Choi <i>Surfaces and Interfaces</i> 27 (2021) 101405. 27. Temperature-dependent interface barrier behavior in MoS₂/n-GaN 2D/3D heterojunction V. Janardhanam, I. Jyothi, Shim-Hoon Yuk, M. Zumuukhorol and Chel-Jong Choi <i>Materials Letters</i> 296 (2021) 129893. 28. 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 <i>Intermetallics</i> 133 (2021) 107178. 29. 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 <i>Journal of Materials Science: Materials in Electronics</i> 32 (2021) 8092-8105.
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 α -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.



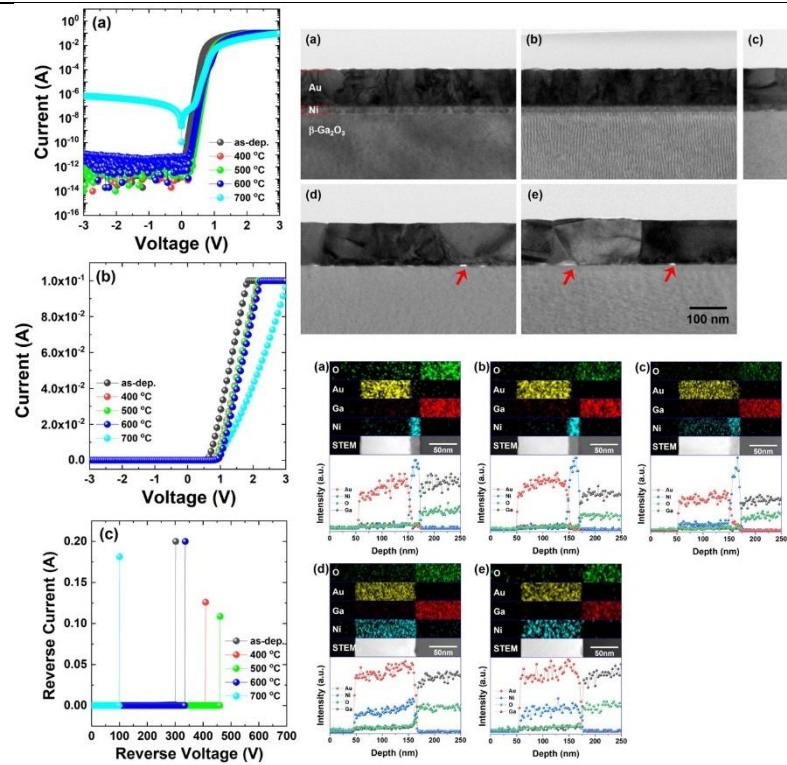
2. Self-powered MoS₂/n-type GaN heterojunction photodetector with broad spectral response in ultraviolet–visible–near-infrared range

An MoS₂/n-type GaN 2-dimensional (2D)/3-dimensional (3D) hybrid heterojunction photodiode was fabricated by layer transfer of a large-scale grown MoS₂ film on a GaN substrate. The MoS₂/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 $\pm 3 \text{ V}$, respectively. The detectivity and noise-equivalent power of the photodiode were determined to be, respectively, $9.08 \times 10^{14} \text{ cm} \cdot \text{Hz}^{1/2} \cdot \text{W}^{-1}$ and $5.50 \times 10^5 \text{ pW} \cdot \text{Hz}^{-1/2}$ 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 MoS₂/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 MoS₂/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 (V_{br}) 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 V_{br} 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,
Invited Talks	Invited Talks - Source/Drain engineering by self-aligned germanide formation and Fermi-level depinning for germanium-based MOS devices International Conference on Optoelectronics and Advanced Materials, ICOAM-2021, Mar. 26-27 (2021) Tirupati, India. - Two-dimensional (2D) transition metal dichalcogenides and wide/ultra-wide bandgap semiconductor-based hybrid heterojunction photodiodes International Conference on Advanced Materials, Devices and Technologies, ICAMDT-2023, Nov. 6 -7 (2023), Tirupati, India. Invited Seminar - Two-dimensional (2D) transition metal dichalcogenides/GaN hybrid heterojunction photodiodes Virtual Seminar Series – 2023, 27th June 2023, Vellore Institute of Technology, Vellore.
Group Members (PhD Students and Projects) Open Positions: If any	PhD Students - Anushree K - Shreya S B - Subba Reddy P Ph.D. positions open :1