Dr. Habib Ahmad

Email: habib.ahmad@iiu.edu.pk
habiba2z@yahoo.com

ACADEMIC QUALIFICATIONS

Doctor of Philosophy	Dec 2021	Georgia Institute of Technology, U.S.A.	Electrical and Computer Engineering	3.71/4	Investigation of III-Nitride High-Power Electronic and Optoelectronic Devices
Master of Science	April 2014	National University of Sciences & Technology (NUST), Islamabad, Pakistan	Electrical Engineering	3.75/4	Design and Development of GaN-based Monolithic Tunable Multi-wavelength LEDs
Bachelor of Science	Sep 2008	UET Peshawar, Pakistan	Electrical Engineering	3.16/4	Automatic Toll Collection System

PROFESSIONAL WORK EXPERIENCE

- **Assistant Professor**
  Center for Advance Electronics and Photovoltaic Engineering (CAEPE)
  IIU, Islamabad
  Aug 2022 to present

- **Graduate Research Assistant**
  Georgia Institute of Technology
  Jan 2017 to December 2021

- **Technical Manager**
  National Engineering & Scientific Commission
  Islamabad, Pakistan
  Technical Manager
  September 2008 to September 2016

- **Graduate Researcher**
  National Institute for Laser & Optronics (NILOP), PAEC, 2013

AWARDS AND ACHIEVEMENTS

- Presidential Award for achieving top position in F.Sc.
- Gold medal from Malakand Board of Intermediate & Secondary Education.
- "Officers' Commendation Certificate," National Engineering & Scientific Commission.
- Gold medal 5th NESCOM football tournament.
- NESCOM merit scholarship award for Bachelor's in Electrical Engineering.
- NUST merit scholarship award for Master's in Electrical Engineering.
- Fulbright Scholarship for PhD in Electrical Engineering at Georgia Institute of Technology.
- Summer 2019 Georgia Tech Intramural Soccer Champion.

- Best PhD Dissertation Award Nomination 2022.

JOURNAL PAPERS

- **Habib Ahmad**, Zachary Engel, Christopher M. Matthews, Sangho Lee, and W. Alan Doolittle, "Realization of Homojunction PN AlN Diodes," *Journal of Applied Physics* **131** (17), 175701 (2022).

- **Habib Ahmad**, Zachary Engel, Aheli Ghosh, Christopher M. Matthews, and W. Alan Doolittle, "GaN:Be I-layer Based High-Power PIN Diodes Achieving Large Quasi-vertical MBE Breakdown Performance," *IEEE Transactions on Electron Devices* **69** (5), 2566 (2022).

- Keisuke Motoki, Zachary Engel, Christopher M. Matthews, **Habib Ahmad**, Timothy M. McCrone, Kohei Harada, and W. Alan Doolittle, "Observation of interfacial strain relaxation and electron beam damage thresholds in $Al_{0.3}In_{0.7}N$/GaN heterostructures by transmission electron microscopy," *Journal of Vacuum Science & Technology B* **40**, 052210 (2022).

- Pao-Chuan Shih, Girish Rughoobur, Zachary Engel, **Habib Ahmad**, William Alan Doolittle, Akintunde I. Akinwande, and Tomas Palacios, "Stable and High Performance AlGaN Self-Aligned-Gate Field Emitter Arrays," *IEEE Electron Device Letters* **43** (8), 1351 (2022).

- Pao-Chuan Shih, Zachary Engel, **Habib Ahmad**, William Alan Doolittle, and Tomas Palacios, "Wet-based digital etching on GaN and AlGaN," *Applied Physics Letters* **120** (2), 022101 (2022).

- **Habib Ahmad**, Jeff Lindemuth, Zachary Engel, Christopher M. Matthews, Timothy M. McCrone, and William Alan Doolittle, "Substantial P-Type Conductivity of AlN Achieved via Beryllium Doping," *Advanced Materials* **33** (42), 2104497 (2021).

- **Habib Ahmad**, Zachary Engel, Muneeb Zia, Alex S. Weidenbach, Christopher M. Matthews, Bill Zivasatienraj, Muhannad S. Bakir, and William Alan Doolittle, "Cascaded Ni hard mask to create chlorine-based ICP dry etched deep mesas for high-power devices," *Semiconductor Science and Technology* **36**, 125016 (2021).

- **Habib Ahmad**, Zachary Engel, Christopher M. Matthews, and Willam Alan Doolittle, "p-type AlN Based Heteroepitaxial Diodes with Schottky, PIN and Junction Barrier Schottky Character Achieving Significant Breakdown Performance," *Journal of Applied Physics* **130** (19), 195702 (2021).

- Yee Rui Koh[*], Md Shafkat Bin Hoque[*], **Habib Ahmad**[*], David H. Olson, Zeyu Liu, Jingjing Shi, Wang Steven, Kenny Huynh, Eric R. Hoglund, James M. Howe, Mark S. Goorsky, Samuel Graham, Tengfei Luo, Jennifer K. Hite, W. Alan Doolittle, and Patrick E. Hopkins, "High thermal conductivity and thermal boundary conductance of homoepitaxially grown gallium

nitride (GaN) films with thicknesses ranging from 0.25 to 2.1 μm," *Physical Review Materials* **5**, 104604 (2021).

- Zachary Engel, Evan A. Clinton, Keisuke Motoki, **Habib Ahmad**, Christopher M. Matthews, and W. Alan Doolittle, "Adlayer control of tunable AlGaN self-assembled superlattices," *Journal of Applied Physics* **130**, 165304 (2021).

- **Habib Ahmad**, Keisuke Motoki, Evan A. Clinton, Christopher M. Matthews, Zachary Engel, W. Alan Doolittle, "Comprehensive Analysis of Metal Modulated Epitaxial GaN," *ACS Applied Materials & Interfaces* **12** (33), 37693 (2020).

- **Habib Ahmad**, Travis J. Anderson, James C. Gallagher, Evan A. Clinton, Zachary Engel, Christopher M. Matthews, and W. Alan Doolittle, "Beryllium Doped Semi-insulating GaN without Surface Accumulation for Homoepitaxial High Power Devices," *Journal of Applied Physics* **127**, 215703 (2020).

- Md Shafkat Bin Hoque, Yee Rui Koh, Kiumars Aryana, Eric R. Hoglund, Jeffrey L. Braun, David H. Olson, John T. Gaskins, **Habib Ahmad**, Mirza Mohammad Mahbube Elahi, Jennifer K. Hite, Zayd C. Leseman, W. Alan Doolittle, Patrick E. Hopkins, "Thermal conductivity measurements of sub-surface buried substrates by steady-state thermoreflectance," *Review of Scientific Instruments* **92**, 064906 (2021).

- Zhe Cheng, Yee Rui Koh, **Habib Ahmad**, Renjiu Hu, Jingjing Shi, Michael E. Liao, Yekan Wang, Tingyu Bai, Ruiyang Li, Eungkyu Lee, Evan A. Clinton, Christopher M. Matthews, Zachary Engel, Luke Yates, Tengfei Luo, Mark S. Goorsky, W. Alan Doolittle, Zhiting Tian, Patrick E. Hopkins & Samuel Graham, "Thermal Conductance across Harmonic-Matched Epitaxial Al-Sapphire Heterointerfaces," *Communication Physics* **3,** 115 (2020).

- Yee Rui Koh, Jingjing Shi, Baiwei Wang, Renjiu Hu, **Habib Ahmad**, Sit Kerdsongpanya, Erik Milosevic, W. Alan Doolittle, Daniel Gall, Zhiting Tian, Samuel Graham, and Patrick E. Hopkins, "Thermal boundary conductance across epitaxial grown metal/sapphire interfaces," *Phys. Rev. B* **102**, 205304 (2020).

- **Habib Ahmad**, Shahzad Hussain and Ijteba-ul-Hasnain Shah, "TCAD Design of InGaN-based Monolithic Multi-wavelength LED with controlled Power Spectral Distributions," *Optik - International Journal for Light and Electron Optics* **126** (21), 3140 (2015).

- Shahzad Hussain, **Habib Ahmad** and Ijteba-ul-Hasnain Shah, "Design of a Monolithic Dual Emission InGaN Based White Light-Emitting Diode," *Journal of Nanoelectronics and Optoelectronics* **9** (3), 338 (2014).

Conference Papers

- Jingjing Shi, Anusha Krishnan, A F M Anhar Uddin Bhuiyan, Yee Rui Koh, Kenny Huynh, Akhil Mauze, Sai Mu, Brian Foley, **Habib Ahmad**, Takeki Itoh, Yuewei Zhang, Zixuan Feng, Chao Yuan, Samuel Kim, W. Alan Doolittle, Chris Van de Walle, James S. Speck, Mark Goorsky, Patrick Hopkins, Hongping Zhao, Samuel Graham, "Thermal transport across Al-$(Al_xGa_{1-x})_2O_3$ and Al-Ga_2O_3 interfaces," *Proceedings of the ASME 2021 International Technical Conference*

and Exhibition on Packaging and Integration of Electronic and Photonic Microsystems InterPACK2021.

- Nabeel Khalid, Hamood ur Rehman, T. Tauqeer, and **Habib Ahmad**, "Performance Optimization of a Monolithic CdZnO Active Layer based double quantum well LED," *High-capacity Optical Networks and Enabling/Emerging Technologies (HONET)*, 2015.

- **Habib Ahmad**, Ijteba-ul-Hasnain Shah, Muhammad Owais Tariq, and Muhammad Shehzaz, "Design of a voltage-tunable tricolor (Blue/Cyan/Green) monolithic solid state LED," *11th IEEE International Bhurban Conference on Applied Sciences and Technology (IBCAST)*, 2014.

- Muhammad Shehbaz, Mojeeb Bin Ihsan, Anis Chaudhary, Ijteba-ul-Hasnain Shah, and **Habib Ahmad**, "Performance comparison of λg/2 and ring resonator based oscillators," *11th IEEE International Bhurban Conference on Applied Sciences and Technology (IBCAST)*, 2014.

PATENT APPLICATIONS

- **Habib Ahmad** and W. Alan Doolittle, "High Breakdown High-Power AlN Schottky Diode," *Invention Disclosure*, Submitted Sep 15, 2021.

- **Habib Ahmad**, Zachary Engel, Alex S. Weidenbach, and W. Alan Doolittle, "Cascaded Ni Hard Mask to Create ICP Dry Etched Deep Mesas for High-Power Devices," *Invention Disclosure*, Submitted Aug 12, 2021.

- **Habib Ahmad**, Zachary Engel, and W. Alan Doolittle, "Improved Breakdown Performance in High-Power Devices via Thin Current Spreading Layers," *Invention Disclosure*, Submitted Aug 12, 2021.

- **Habib Ahmad**, Zachary Engel, and W. Alan Doolittle, "First-time Experimental Achievement of Junction Barrier Schottky Diodes via Relaxed p-AlN on n-GaN Films," *Invention Disclosure*, Submitted Aug 12, 2021.

- **Habib Ahmad**, Zachary Engel, Christopher M. Matthews, Keisuke Motoki, W. Alan Doolittle, "First Experimental Demonstration of P-type AlN Grown by MME," *Invention Disclosure*, Submitted Jan 31, 2021.

- Zachary Engel, W. Alan Doolittle, Evan Clinton, Asif Khan, **Habib Ahmad**, M. Kamal Hussain, Richard Floyd, Mike Gaevski, Mamun Abdullah, Christopher M. Matthews, "Surface Protection Technique for MBE-MOCVD Hybrid Growths**"** *Invention Disclosure*, Approved April 06, 2020.

BOOK CHAPTERS

- **Habib Ahmad** and W. Alan Doolittle, "P-type Doping of III-Nitrides," *Book Chapter ready for submission*.

- David H. Olson, Ashutosh Giri, John A. Tomko, John T. Gaskins, **Habib Ahmad**, W. Alan Doolittle, Patrick E. Hopkins, "5 - Upper limits to thermal conductance across gallium nitride interfaces: Predictions and measurements," Editor(s): Marko J. Tadjer, Travis J. Anderson,

In Woodhead Publishing Series in Electronic and Optical Materials, Thermal Management of Gallium Nitride Electronics, Woodhead Publishing, 2022, Pages 83-102, ISBN 9780128210840, https://doi.org/10.1016/B978-0-12-821084-0.00004-4.

INVITED TALKS

- W. Alan Doolittle, **Habib Ahmad**, Zachary Engel, Christopher M. Matthews, and Keisuke Motoki, "Chemical and Kinetic Mechanisms to Overcome Perceived Limitations in III-Nitride Epitaxy," *21st ICMBE, Puerto Vallarta-Mexico* September 6-9, 2021.

- W. Alan Doolittle, Zachary Engel, Christopher M. Matthews, and **Habib Ahmad**, "Chemical and Kinetic Mechanisms to Overcome Perceived Limitations in III-Nitride Epitaxy," *Materials Research Society, Boston, Massachusetts* Nov 29-Dec 2, 2021.

CONFERENCE PRESENTATIONS

- Christopher M. Matthews, **Habib Ahmad**, Zachary Engel, Keisuke Motoki, Sangho Lee, and W. Alan Doolittle, "AlN Homojunction PN Diodes—The Highest Bandgap Semiconductor Diodes Ever Demonstrated," *64th Electronic Materials Conference*, Columbus Ohio, Jun 26-29, 2022.

- **Habib Ahmad**, Jeff Lindemuth, Zachary Engel, Christopher M. Matthews, Timothy M. McCrone, and W. Alan Doolittle, "First Time Achievement of MME Grown P-type AlN:Be Films," *21st ICMBE, Puerto Vallarta, Mexico* September 6-9, 2021.

- **Habib Ahmad**, Zachary Engel, Christopher M. Matthews, Keisuke Motoki, W. Alan Doolittle, "First Experimental Demonstration of P-type AlN Grown by MME," *63rd Electronic Materials Conference*, Virtual Conference, June 23-25, 2021.

- Zachary Engel, **Habib Ahmad**, Christopher M. Matthews, Keisuke Motoki, and W. Alan Doolittle, "Metal Rich, Low Temperature MME Growth of Aluminum Indium Nitride in the Entire Composition Range," *21st ICMBE, Puerto Vallarta, Mexico* September 6-9, 2021.

- Zachary Engel, **Habib Ahmad**, and W. Alan Doolittle, "Novel Approach for Growth of High-Quality Aluminum Indium Nitride Covering the Entire Composition Range," *Materials Research Society, Boston, Massachusetts* Nov 29-Dec 2, 2021.

- Zachary Engel, Evan A. Clinton, Keisuke Motoki, **Habib Ahmad**, Christopher M. Matthews, and W. Alan Doolittle, "Self-Assembled AlGaN Superlattices Grown Via Metal Modulated Epitaxy," *21st ICMBE, Puerto Vallarta, Mexico* September 6-9, 2021.

- Keisuke Motoki, Zachary Engel, Christopher M. Matthews, **Habib Ahmad**, and W. Alan Doolittle, "Observation of Interfacial Strain Relaxation in High Indium, AlInN/GaN Heterostructures by Transmission Electron Microscope" *63rd Electronic Materials Conference*, Virtual Conference, June 23-25, 2021.

- Adam Payne, Alex H. Rao, Zachary Engel, Chris M. Matthews, **Habib Ahmad**, Terence Brown, W. Alan Doolittle, "Machine Learning for Evaluation of RHEED Spectra on III-Nitride Films Grown Using Molecular Beam Epitaxy," *63rd Electronic Materials Conference*, Virtual

Conference, June 23-25, 2021.

- **Habib Ahmad**, Keisuke Motoki, Evan A. Clinton, Christopher M. Matthews, Zachary Engel, W. Alan Doolittle, "Impact of Substrate Temperature for High Quality Regrown GaN Homoepitaxial Films Grown by Metal Modulated Epitaxy," *62nd Electronic Materials Conference*, Ohio, Jun 24-26, 2020.

- **Habib Ahmad**, Keisuke Motoki, Evan A. Clinton, Christopher M. Matthews, Zachary Engel, W. Alan Doolittle, "Extensive Study of Ga-coverage in UID Regrown GaN by MBE," *62nd Electronic Materials Conference*, Ohio, Jun 24-26, 2020.

- **Habib Ahmad**, Travis J. Anderson, James C. Gallagher, Evan A. Clinton, Zachary Engel, Christopher M. Matthews, and W. Alan Doolittle, "Be Doping of Semi-Insulating GaN without Surface Accumulation using MME," *62nd Electronic Materials Conference*, Ohio, Jun 24-26, 2020.

- Zachary Engel, Christopher M. Matthews, Evan Clinton, **Habib Ahmad**, and W. Alan Doolittle, "Advancements in Aluminum Indium Nitride Growth over a Wide Compositional Range—Towards Long Wavelength III-Nitride Optoelectronics," *62nd Electronic Materials Conference*, Ohio, Jun 24-26, 2020.

- **Habib Ahmad**, Evan A. Clinton, Christopher M. Matthews, Zachary Engel, and W. Alan Doolittle, "Dramatic Improvement in the Surface Quality of High Temperature Annealed c-plane (0001) Sapphire Substrates and its Impact on the Quality of AlN Films from 1 nm to 2 μm," *ICNS-13*, Seattle, Jul 7-12, 2019.

- Yee Rui Koh, **Habib Ahmad**, John T. Gaskins, Jeffrey L. Braun, John Tomko, W. Alan Doolittle, and Patrick E. Hopkins," Size effects of the AlN on the Thermal Transport across Metal/semiconductor Interface," *ICNS-13*, Seattle, Jul 7-12, 2019.