

# Ferhat Bayram

Electrical Engineering Ph.D. candidate with a strong background in III-V semiconductors and nitride MEMS based sensor applications. Established a successful track record in semiconductor device development and characterization. Comprehensive knowledge in semiconductor materials, device physics and nonlinearity in MEMS.

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Ferhat Bayram



## EDUCATION

- **Doctor of Philosophy in Electrical Engineering** (GPA 4.00/4.00) Expected: 2021  
Clemson University, Clemson, SC, United States  
Supervisor: Dr. Goutam Koley  
Dissertation: Piezotransistive III-Nitride Resonant Microcantilevers for Sensing Applications
- **Master of Science in Electrical Engineering** (GPA 3.80/4.00) August 2014  
Clemson University, Clemson, SC, United States  
Supervisor: Dr. W. Rod Harrell
- **Bachelor of Science in Electrical and Electronics Engineering** (GPA 3.10/4.00) October 2009  
Istanbul University, Istanbul, Turkey

## RESEARCH EXPERIENCE

**Graduate Research Assistant** 2014 – Present  
Clemson University, Clemson, SC, United States  
Main Research Project(s):

- **Nonlinear dynamics in GaN microcantilevers:** Investigated nonlinear phenomenon in piezotransistive AlGaIn/GaN heterojunction field effect transistor (HFET) embedded GaN microcantilevers by developing the required experiment setups for low-pressure measurements. Developed theoretical model to predict nonlinear behavior of microcantilevers with varying dimensions.
- **MEMS based mechanical memory:** Investigated multiple methods to excite GaN micro-resonators in their nonlinear region. Demonstrated for the first time optically induced dynamic mechanical memory operations at room temperatures.
- **GaN microcantilever based chemical and biological sensors:** Designed and conducted surface work function based NO<sub>2</sub> sensing experiments utilizing GaN microcantilevers.
- **Optoelectromechanical VO<sub>2</sub> resonators:** Developed and characterized VO<sub>2</sub> layer integrated microcantilevers and micro-membranes. Conducted studies on infrared light modulation utilizing metal-insulator-transition properties of VO<sub>2</sub> thin films.

## PROFESSIONAL EXPERIENCE

**Research Engineer Intern** Fall 2019  
CFD Research Corporation  
701 McMillian Way NW, Huntsville, AL, United States  
Project(s):

- **Real time blood coagulopathy diagnostics:** Planned and executed necessary experiments to develop a portable sensor system for coagulopathy. (Department of Defense-Funded, Award#: DHA19A-001)
- **Micro-resonator-based point of care (POC) sensor platform testing:** Characterized electrical and mechanical properties of the microcantilevers and evaluated the performance of this microcantilever based sensing platform using different fluidic analytes.
- **Computer controlled data acquisition:** Developed and optimized a LabVIEW based control panel to obtain and record the output of the integrated sensing system.

## TECHNICAL/COMPUTER SKILLS

- **Device characterization tools:** Oscilloscope • Source measurement unit • Lock-in amplifier • LCR meter • Function generator • Data acquisition unit • Signal analyzer • Impedance analyzer • Probe station • Wire bonder • Turbo pump vacuum system.
- **Matlab/Simulink:** Data analyzing and modeling the experimental results.
- **Labview:** Data acquisition for real time sensor operations.

- **SAS/R:** Correlation and regression analysis of the experimental findings.
- **Additional Software:** Ltspice, Eagle, AutoCAD, Solidworks, Microsoft Office, Photoshop.

## HONOR AND AWARDS

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|---|-----------|
| • 2021 Clemson University Doctoral Dissertation Completion Grant Recipient                | Fall 2020 |
| • NSF INTERN Award for non-academic research internship for graduate students             | Fall 2019 |
| • Professional Enrichment Grant (PEG) from Clemson University Graduate Student Government | Fall 2018 |
| • IEEE NMDC 2018 Student Travel Award   | Fall 2018 |
| • Turkish Ministry of National Education Fellowship                                       | 2012-2018 |
| • Academic Success Scholarship for Undergraduate Education                                | 2005-2009 |

## SERVICE ACTIVITIES

- |   |                                    |
|---|------------------------------------|
| • Graduate Student Mentor for Summer Undergraduate Research Experience (SURE) Program | Summer 2015                        |
| • Vice President, Turkish Student Association (TSA), Clemson University               | 2015-2016                          |
| • Referee work  |                                    |
| ○ IEEE Electron Device Letters  | ○ Applied Physics Letters          |
| ○ Applied Physics A   | ○ IEEE J-EDS                       |
| ○ 2019 - 2020 IEEE Sensor Conferences   | ○ IEEE JMEMS                       |
|   | ○ Review of Scientific Instruments |
| • Professional Membership   |                                    |
| ○ Institute of Electrical and Electronics Engineers (IEEE) Student Member             |                                    |

## JOURNAL AND CONFERENCE PUBLICATIONS

1. **Bayram, F.**, Khan, D., Gajula, D., & Koley, G. "Dynamic Memory Operations with Photoacoustically Excited Piezotransistive GaN Microcantilevers", **Nature Communications** (submitted), 2020.
2. Li, H., Walsh, K., **Bayram, F.**, Khan, D., & Koley, G. "Direct measurement of K<sup>+</sup> ion efflux from neuronal cells using graphene-based ion sensitive field effect transistor", **RSC Advances**, 2020.
3. **Bayram, F.**, Gajula, D., Khan, D., & Koley, G. "Investigation of AlGa<sub>0.3</sub>N/GaN HFET and VO<sub>2</sub> Thin Film based Deflection Transducers Embedded in GaN Microcantilevers", **Micromachines**, 2020.
4. Khan, D., Li, H., Gajula, D., **Bayram, F.**, & Koley, G. "H<sub>2</sub> detection using plasmonically generated surface photoacoustic wave in Pd nanoparticle deposited GaN Microcantilevers", **ACS Sensors**, 2020.
5. Khan, D., Li, H., **Bayram, F.**, Gajula, D., & Koley, G. "Photoacoustic Detection of H<sub>2</sub> and NH<sub>3</sub> Using Plasmonic Signal Enhancement in GaN Microcantilevers", **Micromachines**, 2020.
6. Pedowitz, M.D., Kim, S., Lewis, D.I., Uppalapati, B., Khan, D., **Bayram, F.**, Koley, G., & Daniels, K.M. "Fast Selective Sensing of Nitrogen-Based Gases Utilizing MnO<sub>2</sub>-Epitaxial Graphene-Silicon Carbide Heterostructures for Room Temperature Gas Sensing", **Journal of Microelectromechanical Systems**, 2020.
7. **Bayram, F.**, Gajula, D., Khan, D., Gorman, S., & Koley, G. "Nonlinearity in piezotransistive GaN microcantilevers", **Journal of Micromechanics and Microengineering**, 2019.
8. Li, H., Singh, A., **Bayram, F.**, Childress, A. S., Rao, A. M., & Koley, G. "Impact of oxygen plasma treatment on carrier transport and molecular adsorption in graphene", **Nanoscale**, 2019.
9. **Bayram, F.**, Khan, D., Li, H., Hossain, M. M., & Koley, G. "Piezotransistive GaN microcantilevers based surface work function measurements", **Japanese Journal of Applied Physics**, 2018.
10. Khan, D., **Bayram, F.**, Gajula, D., Talukdar, A., Li, H., & Koley, G. "Plasmonic amplification of photoacoustic waves detected using piezotransistive GaN microcantilevers", **Applied Physics Letters**, 2017.
11. Azad, S., Singh, R., Munna, M., **Bayram, F.**, Khan, D., Li, H., & Koley, G. "Investigation of VO<sub>2</sub> Thin Film Grown on III-Nitride Epitaxial Layer", presented in **IEEE-NANO**, 2020.
12. Gajula, D., **Bayram, F.**, Jahangir, I., Khan, D., & Koley, G. "Dynamic response of VO<sub>2</sub> mesa based GaN microcantilevers for sensing applications" presented in **IEEE SENSORS**, 2019.
13. **Bayram, F.**, Khan, D., Kim, S., & Koley, G. "Piezotransistive GaN Microcantilever Based NO<sub>2</sub> Sensing Using Functionalized Nanoscale Thin Films", presented in **IEEE NMDC**, 2018.
14. **Bayram, F.**, Gajula, D., Khan, D., & Koley, G. "Observation of Nonlinear Oscillations in Piezotransistive GaN Microcantilevers", presented in **IEEE NMDC**, 2018.
15. Khan, D., Gajula, D., **Bayram, F.**, & Koley, G. "Plasmonic Absorption Enabled Analyte Detection Using Piezotransistive Microcantilevers", presented in **IEEE NMDC**, 2018.
16. Kim, S., Dong, Y., Gorman, S., Khan, D., **Bayram, F.**, Rao, A. M., & Koley, G. "Multi-mode Integrated Energy Harvester Utilizing Piezoelectricity and Triboelectricity", presented in **IEEE NMDC**, 2018.
17. Singh, R., Khan, D., Gajula, D., **Bayram, F.**, & Koley, G. "Synthesis and Characterization of VO<sub>2</sub> on III Nitride Thin Films Using Low Pressure Chemical Vapor Deposition for Sensing Applications", presented in **IEEE NMDC**, 2018.
18. Khan, D., **Bayram, F.**, Li, H., Gajula, D., & Koley, G. "Plasmonic enhancement of photoacoustic signal for sensing applications", presented in **75th Annual Device Research Conference**, 2017.
19. **Bayram, F.**, Khan, D., Kim, S., & Koley, G. "AlGa<sub>0.3</sub>N/GaN HFET embedded GaN microcantilevers based potentiometric sensor", presented in **IEEE SENSORS**, 2016.
20. Uddin, M. A., **Bayram, F.**, Koley, G., Zhu, Y., Singh, A., & Jahangir, I. "Epoxy exposure induced electronic properties change of graphene", presented in **IEEE SENSORS**, 2016.