

# Kevin M. Ferri

MATERIALS SCIENTIST · THIN FILM PROCESS ENGINEER

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## Summary

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I am a materials scientist with four years of thin film deposition experience focusing primarily on physical vapor deposition (PVD) techniques. I have applied my expertise in PVD to develop processes for a broad range of materials systems and applications. Currently I have two main projects. The first utilizes thin film geometries to simulate bulk varistor grain boundaries in an effort to study the correlation between phase formation and electronic behavior. My second project focuses on substituting ZnO with high percentages of MgO near the wurtzite to rocksalt phase boundary in an effort to produce hexagonal  $\text{Zn}_{(1-x)}\text{Mg}_x\text{O}$  which is speculated to be ferroelectric. Throughout the past four years, I have taught many individuals both the fundamental science and practical techniques necessary to operate and troubleshoot a wide range of scientific and engineering equipment.

## Education

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**The Pennsylvania State University**, University Park, PA

Nov. 2020

**PH.D. IN MATERIALS SCIENCE AND ENGINEERING**, GPA: 3.88/4.0

Dissertation: *The Non-linear Properties of ZnO Thin Films*

Advisor: Professor Jon-Paul Maria

**Clemson University**, Clemson, SC

May 2016

**B.S. IN PHYSICS AND ASTRONOMY**, GPA: 3.5/4.0

Concentration: Geology

## Professional Experience

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**The Pennsylvania State University**, University Park, PA

Dec. 2017 - Present

PH.D. RESEARCHER

- Simulated bulk varistor grain boundaries using thin films for sophisticated studies on phase formation and evolution.
- Developed a process for thin film deposition of  $\text{Zn}_{(1-x)}\text{Mg}_x\text{O}$  by radio frequency sputtering for emergent ferroelectrics.
- Deposited thin films of magnesium calcium oxide on gallium nitride for High Electron Mobility Transistor (HEMT) studies.
- Studied the effects that sputtering and pulsed laser deposition have on density, roughness, and microstructure of many material systems.
- Designed, assembled, used, and maintained custom PVD process chambers build from a variety of OEM components.
- Characterized thin films with x-ray diffraction, reflectivity, scanning electron microscopy, and atomic force microscopy.
- Organized packing, move, and setup of \$3M+ of capital equipment (including 1- PVD chambers) at Penn State.
- Designed and implemented custom process gas, chilled water, and electrical infrastructure to support laboratory equipment.
- Operated, maintained, and trained individuals on atomic force microscopy.

**North Carolina State University**, Raleigh, NC

June 2016 - Dec. 2017

PH.D. RESEARCHER

- Research group transferred to The Pennsylvania State University in Dec. 2017. Duties were the same as found for the position above.

**Clemson University**, Clemson, SC

Feb. 2015 - June 2016

UNDERGRADUATE RESEARCHER UNDER DR. APPARAO RAO AND RAMAKRISHNA PODILA

- Conducted research on enhanced supercapacitor performance with binder-free helically coiled carbon nanotube electrodes.
- Characterized carbon nanotubes and graphene deposited on steel plates using scanning electron microscopy and Raman spectroscopy.

UNDERGRADUATE RESEARCHER UNDER DR. JOAN MARLER

Feb. 2013 - June 2016

- Studied reaction dynamics and state to state chemical reactions within cold-trapped ions via laser-doppler cooling.
- Designed and implemented mechanical, electrical, and optical components for a RF-Paul trap for laser cooling.

UNDERGRADUATE RESEARCHER UNDER DR. STEPHEN MOSEY

Jan. 2015 - May 2015

- Utilized quantum dot technology to study migration of radioactive waste in soil and underground waterways.
- Designed and implemented an electrical resistivity system applied to a lysimeter.

## Skills

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**Synthesis & Processing** PVD, sputtering (DC, RF, co-sputtering, reactive), electron beam evaporation, pulsed laser deposition, wet and reactive ion etching, photolithography, chemical vapor deposition.

**Characterization** X-ray diffraction, x-ray reflectivity, grazing incidence, atomic force microscopy, scanning electron microscopy, energy dispersive x-ray spectroscopy, ir reflectivity and transmission, Raman spectroscopy, and electrical property measurements (C-V, I-V, C-F, breakdown, hall effect, and ferroelectric).

**Software** Microsoft office, MATLAB, OriginPro, IgorPro, X'Pert Reflectivity, Highscore, CrystalMaker, Solidworks, LaTeX, LabView, and Python (limited exposure).

**Lab Management** Design, assemble, install, and maintain PVD equipment, helium leak checking, install supporting gas, water, and electrical equipment, design electronic circuitry.

**Other Skills** Writing standard operating procedures, performing equipment training's.

## Leadership & Outreach

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**The Pennsylvania State University**, University Park, PA

Jan. 2018 - Present

TEACHING ASSISTANT

- Function as a teaching assistant by grading and teaching a thin films deposition and characterization lab.

**SciBridge**, North Carolina State University, NC

Dec. 2016 - Dec. 2017

MEMBER

- Aid in the design and delivery of experimental kits for education collaborations between Africa and the U.S.

**Society of Physics Students**, Clemson, SC

Aug. 2015 - May 2016

ACCOUNTANT

- Organized and managed finances associated with the organization for club continuation.

## Honors & Awards

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2019 **Second Place**, Electronic Materials and Applications 2019 Poster Competition

Orlando, FL

2012-2016 **Fellow**, South Carolina Palmetto Fellows Scholar

Clemson, SC

2012-2016 **Fellow**, Clemson Palmetto Pact Scholar

Clemson, SC

## Presentations

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1. *Non-linear Properties of ZnO*, Talk, Electronic Materials and Applications 2020, Orlando FL, Jan. 2020

2. *Thin Film Varistor Prototypes*, Talk, International Conference on Electroceramics, Lausanne Switzerland, July 2019

3. *Investigating the role of grain size, dopant choice, and orientation of ZnO thin film varistor prototypes*, Poster, Electronic Materials and Applications 2019, Orlando FL, Jan. 2019

4. *Structure-process-property relationships in HfN thin films on sapphire*, Talk, Electronic Materials and Applications 2017, Orlando FL, Jan. 2017

5. *Low temperature chemistry with trapped ions*, Poster, American Physics Society Southeastern Section, Columbia SC, Nov. 2014

## Scientific Papers

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1. **Ferri, K.**, Paisley, E., DiAntonio, C., and Maria, J-P. Investigation of phase evolution within  $ZnO\ Bi_2O_3$  varistors utilizing thin film prototypes, *in preparation* (2020)
2. Song, Y., Lundh, J., Wang, W., Leach, J., Eichfield, D., Krishnan, A., Perez, C., Borman, T., **Ferri, K.**, Maria, JP., Chowdhury, S., Ryou, J., Foley, B., Choi, S., The doping dependence of the thermal conductivity of bulk gallium nitride substrates, InterPACK, *under review* (2020)
3. Childress, A., **Ferri, K.**, Rao, A., Enhanced supercapacitor performance with binder-free helically coiled carbon nanotube electrodes. Carbon **140**, 377-384 (2018)
4. Rost, C., Braun, J., **Ferri, K.**, Backman, L., Giri, A., Opila, E., Maria, JP., Hopkins, P., Hafnium nitride films for thermoreflectance transducers at high temperatures: Potential based on heating from laser absorption. Appl. Phys. Lett. **111**, 151902 (2017)