

# Kevin M. Ferri

MATERIALS SCIENTIST · THIN FILM PROCESS ENGINEER

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## Summary

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I am a materials scientist with five years of thin film deposition experience focusing primarily on physical vapor deposition (PVD) techniques for a broad range of materials systems and applications. My dissertation has focused on emergent dielectric and conducting phenomena at phase boundaries and physical interfaces in ZnO-based material systems. Throughout the past seven years, I have collaborated with many individuals on both fundamental science and the 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

Feb. 2021

**PHD IN MATERIALS SCIENCE AND ENGINEERING**, GPA: 3.88/4.0

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

Thesis Advisor: Dr. Jon-Paul Maria

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

June 2016 - Dec. 2017

**PHD IN MATERIALS SCIENCE AND ENGINEERING**, GPA: 3.7/4.0

Research group moved to The Pennsylvania State University in December 2017.

**Clemson University**, Clemson, SC

May 2016

**B.S. IN PHYSICS**, GPA: 3.54/4.0

Concentration: Geology

## Professional Experience

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

Dec. 2017 - Present

PHD RESEARCHER UNDER DR. JON-PAUL MARIA

- Designed, fabricated, and tested oxide diffusion couples based on ZnO and Bi<sub>2</sub>O<sub>3</sub> thin films to research fundamental varistor phenomena which are otherwise difficult to study in bulk form
- Developed a process to stabilize the wurtzite phase for sputtered Zn<sub>1-x</sub>Mg<sub>x</sub>O films substituted with high fractions of MgO near the solubility limit, in an effort to obtain ferroelectric switching
- Controlled interfacial properties at heteroepitaxial interfaces between the structurally and chemically dissimilar materials of rock-salt Mg-CaO and wurtzite GaN for improved oxide-nitride high electron mobility transistor thin films
- Utilized reactive co-sputtering to control the stoichiometry and maximize the thermoreflectance coefficient for HfN thin film transducers
- Synthesized several classes of materials including metals, oxides, and nitrides, for collaborations and initial explorations
- Designed, assembled, and maintained custom PVD process equipment and support infrastructure built from a variety of OEM components
- Characterized thin films with X-ray diffraction/reflectivity, scanning electron microscopy, and atomic force microscopy on a daily basis

**Clemson University**, Clemson, SC

UNDERGRADUATE RESEARCHER UNDER DR. APPARAO RAO AND RAMAKRISHNA PODILA

Feb. 2015 - June 2016

- Developed a process for obtaining binder-free helically coiled carbon nanotube electrodes by metal organic chemical vapor deposition for enhanced supercapacitor performance.
- Characterized carbon nanotubes and graphene films deposited on steel plates using scanning electron microscopy and Raman spectroscopy.

UNDERGRADUATE RESEARCHER UNDER DR. JOAN MARLER

Feb. 2013 - June 2016

- Studied chemical reaction dynamics and electron energy state changes within cold-trapped ions via laser-doppler cooling.
- Designed and implemented numerous 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.

## Skills

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**Synthesis & Processing** PVD, sputtering (DC, RF, HiPIMS, reactive), electron beam evaporation, pulsed laser deposition, chemical vapor deposition, etching, photolithography, powder processing, and sintering.

**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.

**Lab Management** Design, assemble, install, and maintain PVD equipment and support infrastructure including gas, water, and electrical equipment, perform helium leak checking, and design electronic circuitry. Write standard operating procedures and provide training to new users for vacuum, sintering, and characterization equipment.

## Scientific Papers

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1. **Ferri, K.**, Zu, R., Zhu, W., Imperatore, M., Hayden, J., Gopalan, V., Giebink, C., Trolier-Mckinstry, S., and Maria, JP. *ZnMgO: A II-VI semiconductor based ferroelectric, in preparation* (2020)
2. **Ferri, K.**, Paisley, E., DiAntonio, C., and Maria, JP. *Investigation of phase evolution within ZnO–Bi<sub>2</sub>O<sub>3</sub> varistors utilizing thin film prototypes, submitted* (2020)
3. 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*, J. Electron. Packag. **142**, 041112 (2020)
4. Childress, A., **Ferri, K.**, Rao, A., *Enhanced supercapacitor performance with binder-free helically coiled carbon nanotube electrodes*, Carbon **140**, 377-384 (2018)
5. 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)

## Presentations

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1. *Ferroelectrics everywhere and the potential for sputtered Zn<sub>1-x</sub>Mg<sub>x</sub>O ferroelectrics*, Talk, International Symposium on Applications of Ferroelectrics (ISAF), Boulder CO, July 2020
2. *Non-linear Properties of ZnO*, Talk, Electronic Materials and Applications 2020, Orlando FL, Jan. 2020
3. *Thin Film Varistor Prototypes*, Talk, International Conference on Electroceramics, Lausanne CH, July 2019
4. *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
5. *Structure-process-property relationships in HfN thin films on sapphire*, Talk, Electronic Materials and Applications 2017, Orlando FL, Jan. 2017

## Honors & Awards

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2019	<b>Second Place</b> , Electronic Materials and Applications 2019 Poster Competition	Orlando, FL
2012-2016	<b>Fellow</b> , South Carolina Palmetto Fellows Scholar	Clemson, SC
2012-2016	<b>Fellow</b> , Clemson Palmetto Pact Scholar	Clemson, SC