Kevin M. Ferri

Materials Scientist · Thin Film Process Engineer

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Summary

Materials scientist with four years of thin film deposition experience focusing primarily on physical vapor deposition (PVD) techniques for a broad range of materials systems and applications. Currently focusing on 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. The second focuses on substituting ZnO with high percentages of MgO near the wurtzite / rocksalt phase boundary in an effort to produce hexagonal $Zn_{(1-x)}Mg_xO$ which is speculated to be ferroelectric. 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

The Pennsylvania State University, University Park, PA — Dec. 2020

Ph.D. in Materials Science and Engineering, GPA: 3.88/4.0

Dissertation: *The Non-linear Properties of ZnO Thin Films*
Advisor: Dr. Jon-Paul Maria

Clemson University, Clemson, SC — May 2016

B.S. in Physics and Astronomy, GPA: 3.5/4.0

Concentration: Geology

Professional Experience

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 $Zn_{(1-x)}Mg_xO$ by radio frequency sputtering for emergent ferroelectrics.
- Deposited thin films of magnesium calcium oxide on gallium nitride for High Electron Mobility Transistor (HEMT) studies.
- Developed a process for thin film deposition of hafnium nitride by sputtering for time domain thermoreflectance transducers.
- Studied structure-property-process relationships of numerous materials systems using several PVD and characterization techniques.
- Designed, assembled, used, and maintained custom PVD process equipment built from a variety of OEM components.
- Characterized thin films with x-ray diffraction, reflectivity, scanning electron microscopy, and atomic force microscopy.
- Helped organize the packing, movement, and setup of $3M+ of capital equipment (including 9 PVD chambers) at Penn State.
- Designed and implemented custom process gas, chilled water, and electrical infrastructure to support laboratory equipment.

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

Undergraduate Researcher under Dr. Apparao Rao and Ramakrishna Podila — Feb. 2015 - June 2016

- 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

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

The Pennsylania State University, University Park, PA — Jan. 2018 - Present

Teaching Assistant

- Function as a teaching assistant by grading and guiding 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 club continuation.

Honors & Awards

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

1. *Ferroelectrics everywhere and the potential for sputtered $Zn_{(1-x)}Mg_xO$ ferroelectrics*, Talk, International Symposium on Applications of Ferroelectrics (ISAF), Boulder CO, Jul. 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 Switzerland, 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

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

Scientific Papers

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, J. Electron. Packag., *accepted* (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 tranducers at high temperatures: Potential based on heating from laser absorption. Appl. Phys. Lett. **111**, 151902 (2017)