

# ZACHARY TENER

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## PROFESSIONAL EXPERIENCE

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### Scientist 2, Savannah River National Laboratory, 08/2023 – Present

- Beginning an independent career in the Energy and Advanced Materials Group.
- Expanding breadth of work to include magnetic nanoparticles.
- Leveraging prior contribution experience to draft mock proposals in preparation of future funding.

### Postdoctoral Associate: Thermomagnetic Processing, Oak Ridge National Laboratory, 04/2021 – 06/2023

- Developing an *in-situ* neutron diffraction insert to study the effect of applied magnetic fields on bulk metallic materials (ferrous and aluminum alloys) at high temperatures utilizing induction heating.
- Processing materials at high temperatures within superconducting magnets, up to 1100 °C and 9 T.
- Performed hydrogenation-disproportionation desorption-recombination reactions on Nd<sub>2</sub>Fe<sub>14</sub>B-based rare-earth magnetic material within an applied magnetic field.
- Served as the Secretary of the Executive Committee of the Oak Ridge Postdoctoral Association.

### Graduate Teaching and Research Assistant, Florida State University, 06/2015 – 12/2020

- Designed, synthesized, and characterized intermetallic compounds to rationally create new itinerant magnets and magnetocaloric materials, resulting in several published works.
- Performed synchrotron and neutron diffraction experiments at multiple national laboratories.
- Recognized for outstanding teaching in general chemistry and inorganic chemistry lectures and teaching laboratory experiences.
- Appointed to mentorship positions within the research lab and performed outreach to a middle school.

### Research and Development Intern, Integrated DNA Technologies, 01/2015 – 05/2015

- Synthesized experimental fluorescent tags for DNA oligonucleotides.
- Utilized organic synthesis and analytical techniques e.g. column chromatography and H<sup>1</sup> – nuclear magnetic resonance (NMR).

### Ames Laboratory Associate, Ames Laboratory, 01/2014 – 12/2014

- Synthesized intermetallic compounds using solid-state techniques, including arc-melting and flux reactions.

## EDUCATION

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Inorganic Chemistry (Ph.D.), December 2020 Florida State University **GPA:** 3.88 / 4.00

- **Dissertation Title:** *Control of Itinerant Magnetism Through Electronic Structure Modification and Chemical Design.*
- Advised by Prof. Michael Shatruk, explored fundamental control of magnetic properties in chemical systems through electronic structure calculations, directed synthesis, and characterization.
- Performed experiments at Argonne National Laboratory (ANL) including high-pressure synchrotron Mössbauer spectroscopy measurements at the 3-ID beamline and high-pressure synchrotron powder diffraction at the 16-BM beamline. Remotely collected high-resolution synchrotron powder diffraction data at the 11-BM beamline.
- Utilized the Deutsches Elektronen-Synchrotron (DESY), the X-ray Free Electron Laser (XFEL), and the European Synchrotron Research Facility (ESRF) to collaborate on high-pressure X-ray absorption spectroscopy measurements.
- Performed neutron experiments at Oak Ridge National Laboratory (ORNL), including polarized and non-polarized neutron powder diffraction experiments for magnetic structure determination.

- Managed laboratory-scale X-ray powder diffraction and SQUID magnetometry instruments, and was responsible for instrumental upkeep, data collection, and analysis

Chemistry (B.S.), December 2014 Iowa State University **GPA:** 3.35 / 4.00

- Hands-on experience with a suite of analytical instrumentation, including gas and liquid chromatography, mass spectrometry, infrared and ultraviolet spectroscopy, cyclic voltammetry, and  $H^1$  NMR.
- Accepted and completed an undergraduate research opportunity with Ames Laboratory, a Department of Energy national laboratory.

## ADVANCED TECHNICAL SKILLS

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- Inert atmosphere synthesis of oxygen-reactive elements including glovebox use and maintenance.
- Solid-state synthesis techniques including arc-melting, induction melting, chemical vapor transport, flux reactions and etching, and traditional solid-state synthesis methods.
- Polarized and non-polarized powder neutron diffraction (ORNL)
- Powder X-ray crystallography (PXRD)
- Magnetic characterization utilizing both direct- and alternating-current SQUID magnetometry
- High-pressure synchrotron Mössbauer spectroscopy and high-pressure diffraction on powder samples (ANL)
- Scanning electron microscope (SEM) used with an energy-dispersive spectrometer (EDS) attachment.
- Electronic structure calculations using the LMTO (v.47) and VASP packages.
- Rietveld Refinement and quantitative diffraction analysis with HighScorePlus, Fullprof, and GSAS II.
- Data visualization and presentation with Origin, Microsoft Office, and Adobe Photoshop.

## JOURNAL ARTICLES

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- Alnasir, M. H.; Mehmood, M.; Ali, H.; Hashmi, M. T.; **Tener, Z.**; Wang, Y.; Abramchuk, M.; Shatruck, M.; Shahzad, I.; Manzoor, S. Role of Magnetic Anisotropy of Mn-Doped  $Co_2B$  in Self-Controlled Magnetic Hyperthermia. *J. Magn. Magn. Mater.* Submitted.
- Tener, Z. P.**; Yannello, V. J.; Lapidus, S.; Stoian, S. A.; Shatruck, M. Evolution of Bonding and Magnetism via Changes in Valence Electron Count in  $CuFe_{2-x}Co_xGe_2$  ( $0 \leq x \leq 1$ ) *Inorg. Chem.* 2022, *61*, 4257-4269.
- Tener, Z. P.**; Yannello, V. J.; Willis, J.; Garlea, V. O.; Shatruck, M. Magnetization Distribution in  $Cu_{0.6}Mn_{2.4}Ge_2$  Ferromagnet from Polarized and Non-Polarized Neutron Powder Diffraction Aided by Density-Functional Theory Calculations. *J. Magn. Magn. Mater.* 2021, *529*, 167827.
- Yannello, V. J.; Guillou, F.; Yaroslavtsev, A. A.; **Tener, Z. P.**; Wilhelm, F.; Yaresko, A. N.; Molodtsov, S. L.; Scherz, A.; Rogalev, A.; Shatruck, M. Revisiting Bond Breaking and Making in  $EuCo_2P_2$ : Where are the Electrons? *Chem. Eur. J.* 2019, *25*, 5865-5869.
- Tan, X.; **Tener, Z. P.**; Shatruck, M. Correlating itinerant magnetism in  $RCo_2Pn_2$  pnictides ( $R = La, Ce, Pr, Nd, Ca$ ;  $Pn = P, As$ ) to their crystal and electronic structures. *Acc. Chem. Res.* 2018, *51*, 230-239.
- Tan, X.; Garlea, V. O.; Kovnir, K.; Thompson, C. M.; Xu, T.; Cao, H.; Chai, P.; **Tener, Z. P.**; Yan, S.; Xiong, P.; Shatruck, M. Complex magnetic phase diagram with multistep spin-flop transitions in  $La_{0.25}Pr_{0.75}Co_2P_2$ . *Phys. Rev. B* 2017, *95*, 024428.
- Thimmaiah S.; **Tener, Z.**; Lamichhane, T. N.; Canfield, P. C.; Miller, G. J. Crystal structure, homogeneity range and electronic structure of rhombohedral  $\gamma$ - $Mn_5Al_8$ . *Z. Kristallogr.* 2017, *232*, 601-610.

## PATENTS

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1. **Tener, Z.;** Abramchuk, M.; Tan, X.; Shatruck, M.; Misra, S.; Barrera-Bedrano, D. Magnetocaloric Regenerators Comprising Materials Containing Cobalt, Manganese, Boron, and Carbon. Patent WO2018011189A1, filed 2017-07-11, and issued 2018-01-18. <https://patents.google.com/patent/WO2018011189A1>

## AWARDS & HONORS

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- **Teaching:** General Chemistry 1 Outstanding TA Award (2018)
- **Presentations:** 29<sup>th</sup> Rare Earth Research Conference Best Poster Award (2022), Florida Inorganic and Materials Symposium Poster Award – 2nd Place (2017), Florida Inorganic and Materials Symposium Poster Award – 3rd Place (2016)
- **Travel Awards:** FSU Chemistry and Biochemistry Departmental Travel Award (2018), Congress of Graduate Students Travel Award (2016, 2017)

## CONFERENCES & WORKSHOPS

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- ***In-situ* Neutron Characterization of Thermomagnetic Processes Utilizing Direct Induction Heating (Oral Presentation)**  
**Tener, Z. P.**  
*MS&T22 Technical Meeting and Exhibition 2022, Pittsburgh, PA*
- **Utilizing Applied Magnetic Fields to Optimize HDDR-Processed Nd-Fe-B Alloys (Poster Presentation)**  
**Tener, Z. P.;** Liu, X.; Nlebedim, I. C.; Kramer, M. J.; McGuire, M. A.; Kesler, M. S.  
*Critical Materials Institute Annual Meeting 2022, Ames, IA*
- **Optimization of rare-earth content in bonded Nd<sub>2</sub>Fe<sub>14</sub>B-based magnets utilizing applied magnetic field modifications to HDDR treatment (Poster Presentation)**  
**Tener, Z. P.;** Liu, X.; Nlebedim, I. C.; Kramer, M. J.; McGuire, M. A.; Kesler, M. S.  
*29<sup>th</sup> Rare Earth Research Conference 2022, Philadelphia, PA*
- **2020 Virtual Workshop for Magnetic Structure Determination from Neutron Diffraction Data (Workshop Attendee)**  
Oak Ridge National Laboratory, Oak Ridge, TN (Remote)
- **Chemical Bonding in the CuFe<sub>2-x</sub>Co<sub>x</sub>Ge<sub>2</sub> System (Oral Presentation)**  
**Tener, Z. P.;** Yannello, V.J.; Stoian, S. A.; Shatruck, M.  
*A.C.S. National Meeting & Expo: Chemistry for New Frontiers 2019, Orlando, FL*
- **Origin of Magnetism in CuT<sub>2</sub>Ge<sub>2</sub> (T = Mn, Fe, Co) (Poster Presentation)**  
**Tener, Z. P.;** Yannello, V.J.; Stoian, S. A.; Shatruck, M.  
*Gordon Research Conference & Symposium – Solid State Chemistry 2018, New London, NH*
- **NRS Workshop 2017: CONUSS and Synchrotron Mössbauer Data Analysis (Workshop Attendee)**  
Argonne National Laboratory, Chicago, IL
- **“Oxidizing” and “Reducing” CuFe<sub>2</sub>Ge<sub>2</sub> Into Ferromagnetism or Superconductivity (Poster Presentation)**  
**Tener, Z. P.;** Yannello, V.J.; Stoian, S. A.; Shatruck, M.  
*Florida Inorganic and Materials Symposium 2017, Gainesville, FL*
- **2017 National School on Neutron and X-Ray Scattering (Workshop Attendee)**  
Argonne National Laboratory, Chicago, IL; Oak Ridge National Laboratory, Oak Ridge, TN

- **Investigation of Magnetic Phase Transitions in  $\text{CuFe}_{2-x}\text{Co}_x\text{Ge}_2$  (Oral Presentation)**  
Tener, Z. P.  
*Florida Annual Meeting and Exposition 2017, Tampa, FL*
- **Investigation of the  $\text{CuFe}_{2-x}\text{Co}_x\text{Ge}_2$  Series and its Magnetic Properties (Poster Presentation)**  
Tener, Z. P.; Abramchuk, M.; Shatruk, M.  
*Florida Inorganic and Materials Symposium 2016, Gainesville, FL*
- **Investigation of Magnetic Properties in  $\text{CuFe}_2\text{Ge}_2$  and Related Materials (Poster Presentation)**  
Tener, Z. P.; Abramchuk, M.; Shatruk, M.  
*Florida Annual Meeting and Exposition 2016, Tampa, FL*

## PARTICIPANT IN RESEARCH PROJECTS

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- **Development of High Energy Density Thermomagnetic Processing Technology for Intensification of Industrial Heat-treatment and Increased Material Performance,**  
Michael Kesler (PI)  
Funded by the Department of Energy (DE-EE0009131)  
Total award \$11,061,283 (March 2021 – July 2022)  
I am one of the postdoctorate researchers participating in this multi-facility DOE-funded research project.
- **Enhancing HDDR Powders**  
Michael Kesler (PI)  
Project within the Critical Materials Institute, an Energy Innovation Hub  
Funded by the Department of Energy (DE-AC05-00OR22725)  
Total award \$270,000/yr (July 2020 – July 2022)  
I am one of the postdoctorate researchers participating in this multi-facility DOE-funded research project
- **Probing Effects of Pressure, Mixed Valence, and Spin Frustration on Itinerant Magnets**  
Michael Shatruk (PI)  
Funded by the National Science Foundation (1905499)  
Total award \$488,287 (April 2019 – July 2022)  
I was one of the graduate students participating in this NSF-funded research project.
- **Light-Induced Magnetic Switching as a Trigger for Phase Transitions in Molecular Materials**  
Michael Shatruk (PI), Nar Dalal (Co-PI)  
Funded by the National Science Foundation (1464955)  
Total award \$477.169 (September 2015 – April 2019)  
I was one of the graduate students participating in this NSF-funded research project.
- **Investigation of Strongly Correlated Itinerant Magnets and Potential Quantum Spin Liquids**  
Michael Shatruk (PI),  
Funded by National Science Foundation (1507233)  
Total award \$410,000 (June 2015 – November 2019)  
I was one of the graduate students participating in this NSF-funded research project.
- **Investigation of Magnetocaloric Properties in Materials Derived From  $\text{AlFe}_2\text{B}_2$ .**  
Michael Shatruk (PI),  
Funded by BASF Corporation  
Total award \$300,084 (April 2015 – December 2017)  
I was one of the graduate students participating in this effort.