

ZACHARY TENER

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PROFESSIONAL EXPERIENCE

Postdoctoral Associate: Thermomagnetic Processing, Oak Ridge National Laboratory, 04/2021 – Present

- Developing an *in-situ* neutron diffraction insert to study the effect of applied magnetic fields on bulk materials at high temperatures.
- Processing various metallic and inorganic materials at high temperatures within superconducting magnets, up to 1100 °C and 7 T.
- Performed hydrogenation-disproportionation desorption-recombination reactions on rare-earth magnetic material within an applied magnetic field.
- Participated in a user experiment at the NOMAD beamline at ORNL, studying phase-change composite materials for thermal cycling in buildings.
- Serving 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 in research endeavors and performed outreach to a local middle school.

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

- Synthesized experimental fluorescent tags for DNA strings.
- Utilized organic synthesis and analytical techniques such as column chromatography and H^1 – NMR.

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

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

EDUCATION

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 synchrotron radiation 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. Also 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 powder diffraction and Oak Ridge National Laboratory (ORNL) to perform neutron powder diffraction and single-crystal neutron diffraction for magnetic structure determination.

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 X-ray powder diffractometry.
- Accepted and completed an undergraduate research opportunity with Ames Laboratory, a Department of Energy national laboratory.

ADVANCED TECHNICAL SKILLS

- 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) use 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

1. **Tener, Z. P.**, Yarsolavtsev, A. A.; Tan, X.; Shatruk, M. Pressure-Induced Phase Transition in EuMn_2Pn_2 ($\text{Pn} = \text{P, As}$). *Phys. Rev. B*. In Prep.
2. Alnasir, M. H.; Mehmood, M.; Ali, H.; Hashmi, M. T.; **Tener, Z.**; Wang, Y.; Abramchuk, M.; Shatruk, M.; Shahzad, I.; Manzoor, S. Role of Magnetic Anisotropy of Mn-Doped Co_2B in Self-Controlled Magnetic Hyperthermia. *J. Magn. Magn. Mater.* Submitted.
3. **Tener, Z. P.**; Yannello, V. J.; Lapidus, S.; Stoian, S. A.; Shatruk, M. Evolution of Bonding and Magnetism via Changes in Valence Electron Count in $\text{CuFe}_{2-x}\text{Co}_x\text{Ge}_2$ ($0 \leq x \leq 1$) *Inorg. Chem.* Accepted.
4. **Tener, Z. P.**; Yannello, V. J.; Willis, J.; Garlea, V. O.; Shatruk, M. Magnetization Distribution in $\text{Cu}_{0.6}\text{Mn}_{2.4}\text{Ge}_2$ Ferromagnet from Polarized and Non-Polarized Neutron Powder Diffraction Aided by Density-Functional Theory Calculations. *J. Magn. Magn. Mater.* 2021, 529, 167827

5. Yannello, V. J.; Guillou, F.; Yaroslavtsev, A. A.; **Tener, Z. P.**; Wilhelm, F.; Yaresko, A. N.; Molodtsov, S. L.; Scherz, A.; Rogalev, A.; Shatruk, M. Revisiting Bond Breaking and Making in EuCo_2P_2 : Where are the Electrons? *Chem. Eur. J.* 2019, 25, 5865-5869.
6. Tan, X.; **Tener, Z. P.**; Shatruk, 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.
7. Tan, X.; Garlea, V. O.; Kovnir, K.; Thompson, C. M.; Xu, T.; Cao, H.; Chai, P.; **Tener, Z. P.**; Yan, S.; Xiong, P.; Shatruk, M. Complex magnetic phase diagram with multistep spin-flop transitions in $\text{La}_{0.25}\text{Pr}_{0.75}\text{Co}_2\text{P}_2$. *Phys. Rev. B* 2017, 95, 024428.
8. Thimmaiah S.; **Tener, Z.**; Lamichhane, T. N.; Canfield, P. C.; Miller, G. J. Crystal structure, homogeneity range and electronic structure of rhombohedral $\gamma\text{-Mn}_5\text{Al}_8$. *Z. Kristallogr.* 2017, 232, 601-610

PATENTS

1. **Tener, Z.**; Abramchuk, M.; Tan, X.; Shatruk, 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

- **Teaching:** General Chemistry 1 Outstanding TA Award (2018)
- **Presentations:** 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

- **HDDR Treatment on $\text{Nd}_2\text{Fe}_{14}\text{B}$ -based Magnets in the Presence of an Applied Magnetic Field (Oral Presentation)**
Tener, Z. P.; Liu, X.; Nlebedim, I. C.; Kramer, M. J.; McGuire, M. A.; Kesler, M. S.
T.M.S. 2022 Annual Meeting & Exhibition, On-Demand
- **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 $\text{CuFe}_{2-x}\text{Co}_x\text{Ge}_2$ System (Oral Presentation)**
Tener, Z. P.; Yannello, V.J.; Stoian, S. A.; Shatruk, M.
A.C.S. National Meeting & Expo: Chemistry for New Frontiers 2019, Orlando, FL
- **Origin of Magnetism in CuT_2Ge_2 (T = Mn, Fe, Co) (Poster Presentation)**
Tener, Z. P.; Yannello, V.J.; Stoian, S. A.; Shatruk, 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_2Ge_2 Into Ferromagnetism or Superconductivity (Poster Presentation)**
Tener, Z. P.; Yannello, V.J.; Stoian, S. A.; Shatruk, 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 CuFe_2Ge_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

- **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 am 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 am 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 AlFe_2B_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.