SI ATHENA CHEN

siathenachen@gmail.com | chens1@ornl.gov | 814-777-4374 | LinkedIn

1 Bethel Valley Road, Bldg. 7962 Room 217 (MS-6393), Oak Ridge, TN 37830

Education and Degrees

Ph.D.: Dual-title Ph.D. in Geosciences and Biogeochemistry — Aug. 2016 - Dec 2021
Pennsylvania State University – University Park, State College, PA, USA — GPA 3.88/4.00
Advisor: Peter J. Heaney
Summer Break in Wuhan, Hubei, China — *06/2016 to 07/2016*
Bachelor of Science: Gemology and Material Science — Sep. 2012 - May 2016
Information and Communication Engineering — Sep. 2011 - Aug 2012
China University of Geosciences - Wuhan, Hubei, China — GPA 3.92/4.00 (Top Graduate)
Advisor: Meihua Chen, Andy H Shen

Professional Interestes

Crystal nucleation and growth. Reaction kinetics and mechanisms. In-situ X-ray/Neutron Diffraction. Crystal structure analysis. Mineral phase transitions. Transient phenomena.

Technical Skills

- **Structure Characterization Techniques:** Neutron Diffraction, Synchrotron X-ray Diffraction (XRD), Inelastic Neutron Scattering, Atomic Force Microscopy (AFM), Raman Spectroscopy, Fourier-transform Infrared Spectroscopy (FTIR), X-ray fluorescence (XRF), Transmission Electron Microscopy (TEM), Scanning Electron Microscopy (SEM), Focused Ion Beam (FIB), Electron Probe Microanalyzer (EPMA), Thermogravimetric Analysis/Mass Spectrometry (TGA-MS).
- **Computer Skills:** Python, GSAS I/II, CrystalMaker Suite, Fullprof, VESTA, JADE, Dioptas, MATLAB, Adobe Premiere Pro, Adobe Photoshop, Adobe Ligthroom, FinalCutProX.

Work Experiences

Neutron Diffraction Instrument Scientist, 10/2023 to current, Oak Ridge National Laboratory (ORNL), Oak Ridge, TN, US.

Supervisor: Clarina R Dela Cruz, Group Leader, Powder Diffraction Group, Neutron Scattering Division

- Neutron diffraction instrument scientist at the HB-2C Wide-Angle Neutron Diffractometer (WAND^2) in High Flux Isotope Reactor (HFIR), ORNL. Maximize scientific productivity and impact of WAND^2. Conduct a world-leading scientific research program centered around neutron scattering. Taking leadership in outreach, education and mentorship.
- Supporting users from all over the world with experimental setups, data acquisition, data reduction, and analysis, ensuring high-quality research outcomes, pursuing independent research with impactful publications and collaborations.
- Develop and implement new and improved neutron scattering research capabilities that increase the impact and growth of the NScD neutron facilities and User program

Postdoc Researcher, 01/2022 to 09/2023, Oak Ridge National Laboratory (ORNL), Oak Ridge, TN, US.

Supervisor: Andrew G. Stack, Group Leader, Geochemistry & Interfacial Sciences Group, Chemical Science Division

- Lead research on quantitatively determining how impurities influence the lattice strain and affect the rate of single-crystal calcite growth using high-resolution chemical imaging techniques and nanoscale strain mapping. (CNMS user proposal awarded at ORNL, worth $250,000).
- Lead the project on investigating the reaction kinetics and structural mechanisms of amorphous calcium carbonate (ACC) to crystalline $CaCO_3$ transformation under the presence of impurity ions, using time-resolved synchrotron XRD (Beamtime proposal awarded at Argonne National Lab, worth $200,000).

Graduate Research Assistant, 08/2016 to 12/2021, Pennsylvania State University, State College, PA, US.

Supervisor: Peter J. Heaney, Professor of Department of Geosciences

- Studied the growth mechanisms of iron oxides at a broad range of temperatures (5-1200K) and pH (2-13) concentrations mainly using TRXRD and Rietveld analysis at Argonne National Lab.
- Discovered synthesis routes that generate metastable and exceptionally Fe-deficient and hydrous iron oxides and found analogs in natural samples, including the new mineral "hydrogoethite".

Research Intern, 06/2021 to 08/2021, Oak Ridge National Laboratory, Oak Ridge, TN, US.

Supervisor: Bryan C. Chakoumakos, Leader for the Single-Crystal Neutron Diffraction Team

- The Principal Investigator (PI) of the research project: "Hydroxyl Positions and Vibrations in Superhydrous Hydrohematite and Hydrogoethite" using time-resolved Neutron Diffraction (HB-2C $WAND^2$ at High Flux Isotope Reactor) and neutron vibrational spectroscopy (VISION at the Spallation Neutron Source) in Oak Ridge National Lab (ORNL).
- Determined the magnetic structure of hydrohematite and hematite using neutron diffraction.
- Modeled the hydrogen and vacancy position in hydrohematite and calculated their molecular vibrations.

Research Intern, 07/2019 to 08/2019, Gemological Institute of America (GIA), New York City, NY, US.

Supervisor: Wuyi Wang, Vice President of Research and Development

- Solved the cause of color by Fe/Mn oxide micro-inclusions in colored gemstone using Scanning Electron Microscopy (SEM) and Raman Spectroscopy.
- Identified and quantified mineral inclusions using Raman mapping.
- Proposed mechanism for agate formation.

Research Intern, 06/2014 to 07/2014, Gem testing center, Wuhan, Hubei, China

Supervisor: Jingru Di, Head of the Gem testing center

- Research on the uncertainty of measuring the concentration of precious metals such as gold, silver, and platinum using XRF and Optical Microscopes.
- Tested over 5000 precious metals and won First Prize on College Science Annual Report.

Honors and Awards

Early Career Scientist Travel Award in Spring 2023 ACS National Meeting Jan 2023
American Chemical Society.

Graduate Research Exhibition, Third Place FY 2021
Penn State University.

Edward H. Kraus Crystallographic Research Fund May 2021
The Mineralogical Society of America.

Advanced Short-Term Research Opportunity (ASTRO) Fellowship Spring 2020
Oak Ridge National Laboratory.

Krynine Memorial Scholarship Spring 2018 & Fall 2019 & Spring 2020 & Fall 2020
Department of Geosciences, Penn State University.

Hiroshi and Koya Ohmoto Graduate Fellowship Fall 2019
Department of Geosciences, Penn State University.

Electron Probe Microanalysis (EPMA) Research Funds Apr. 2019
Department of Geosciences & Material Characterization Laboratory, Penn State University.

Science Research Competition Nov 2014
1st place, China University of Geosciences (Wuhan)

Advanced Mathematic Competition Feb 2013

First Award, China University of Geosciences (Wuhan)

China National Scholarship 2012-2013

National Outstanding Student Model (top 1%), Chinese Government.

Certificates and Diploma

Gemologist Diploma, Gem-A, The Gemmological Association of Great Britain, Jan 2016;
Gemologist Diploma, Gemological Institute of China University of Geosciences (Wuhan), Mar 2016;
Diploma in Gem Identification, Gemological Institute of China University of Geosciences (Wuhan), Mar 2016;
Diploma in Gem Diamond Grading, Gemological Institute of China University of Geosciences (Wuhan), Mar 2016;
Diploma in Gem Identification, Gemological Institute of China University of Geosciences (Wuhan), Mar 2016;

Leadership and Service

Chair, American Crystallographic Association, Structural Characterizations of Emerging Energy Materials Session, July 2025;
Chair-Elect (FY 2025), Secretary and Treasure (FY 2024), Oak Ridge National Laboratory, Asian Pacific American Committee (APAC);
Co-organizer, Oak Ridge National Laboratory, Asian Cultural Performance (May 13, 2024), Food Sampling Event (May 23, 2024), APAC Food on the Quad (May 30, 2024), and ORNL Traditional Asian Costume Showcase at the 11th Knoxville Asian Festival (Sep 8, 2024);
Chair, Geological Society of America Annual Meeting, Synchrotron X-ray and Neutron Applications in Earth and Environmental Science Session, Sep 2024;
Co-Chair, Geological Society of America Annual Meeting, Early Career Investigators in Mineralogy and Crystallography Session, Oct 2021 & Oct 2022 & Oct 2023 & Sep 2024;
Associate Technical Editor, *Gems and Gemology*, Gemological Institute of America, May 2022 – May 2023;
Committee member, Early Career Panel at the Mineralogical Society of America, 2023-present;
Organizer/Chair, 11th Annual ORPA Research Symposium (May 2023);
Research Chair, Oak Ridge National Laboratory Postdoctoral Association (ORPA), Oct 2022 – Oct 2023;
Member, Education and Outreach Subcommittee of the Geoscience Synchrotron Steering Committee, 2021 – 2022;
Member, Mineralogical Society of America Membership Committee, 2020-2023;
Member, Mineralogical Society of America, since 2017;
Member, Geological Society of America, since 2018;
Member, American Chemical Society, since 2020;
Member, American Crystallographic Association, since 2024;

Outreach

Volunteer-Performer, East Tennessee Children's Hospital, Fantasy of Trees, Nov 30, 2024.
Volunteer-Instructor, ORNL Traveling Science Fair, Oct 3, 2024.
Volunteer-Hostess, University of Tennessee, East Tennessee Chinese New Year Festival, Feb 2024, Feb 2025.
Volunteer-Instructor, ORNL Hour of Code, Ridge View Elementary, Dec 8, 2023.
Volunteer-Speaker, The Bearded Lady Project: Challenging the Face of Science, Penn State Univeristy, May 07, 2019.
Volunteer-Instructor, Mineral Junior Education Day, Central Pennsylvania Institute of Science and Technology, Mar 30, 2019.

Publications

Chen, S.A., Neumayer, S.M., Zachman, M.J., Ievlev, A.V., Poplawsky, J.D., Spano, T.L., Eng, P.J., Stack, P.J., and Weber, J. (2025). Impurity Incorporation and Strain Dynamics in Calcite Crystal Growth: In Situ Analysis and Multiscale Chemical-Strain Mapping. *Geochimica et Cosmochimica Acta (Under Review)*.

Chen, S.A., Weber, J., Starchenko, V., Eng, P.J., Stubbs, J.E., Wang, H.W., Liu, T., Spano, T.L., Chakoumakos, B.C. and Stack, A.G. (2024). Real-Time Atomic-Scale Structural Analysis Resolves the Amorphous to Crystalline $CaCO_3$ Mechanism Controversy. *Crystal Growth & Design*, 24, 12, 5027–5038

Chen, M., Gong, L., Schott, J., Lu, P., Chen, K., Yuan, H., Sun, J., **Chen, S.A.,** Apps, J. and Zhu, C. (2024). Coupled feldspar dissolution and secondary mineral precipitation in batch systems: 6. Labradorite dissolution, calcite growth, and clay precipitation at 60° C and pH 8.2–8.4. *Geochimica et Cosmochimica Acta*.

Zhang, R., Bosomworth, P.A., Weber, J., Ilavsky, J., **Chen, S.A.,** Flores-Betancourt, A., Gilbert, E.P., Mata, J., Rivers, M.L., Eng, P.J. and Anovitz, L.M. (2024). The role of annealing and grain boundary controls on the mechanical properties of limestones and marbles. *International Journal of Rock Mechanics and Mining Sciences*, *183*, p.105926.

Chen, S. A., Chakoumakos, B. C., Kubicki, J. D., Cheng, Y. Q., Daemen, L. D., Post, J. E., & Heaney, P. J. (2023). Hydrogen and vacancy position in hydrohematite: neutron scattering and density functional theory calculations. *Physical Review Materials, in prep*.

Chen, S. A., Heaney, P. J., Post, J. E., Eng, P. J., & Stubbs, J. E. (2022). Hematite-goethite ratios at pH 2-13 and 25-170 °C: A time-resolved synchrotron X-ray diffraction study. *Chemical Geology*, 606, 120995.

Chen, S. A., Heaney, P. J., Post, J. E., Eng, P. J., & Stubbs, J. E. (2022). Vacancy inoculation in exceptionally Fe-deficient hematite: An *in situ* synchrotron X-ray diffraction study of non-classical crystallization. *American Mineralogist*, 108(9), pp.1720-1731.

Page, K., Stack, A. G., **Chen, S. A.**, & Wang, H. W. (2022). Nanopore facilitated monohydrocalcitic amorphous calcium carbonate precipitation. *Physical Chemistry Chemical Physics*, 24(30), 18340-18346.

Chen, S. A., Heaney, P. J., Post, J. E., Fischer, T., Eng, P. J., & Stubbs, J. E. (2021). Superhydrous Hematite and Goethite: A Potential Water Reservoir in the Red Dust of Mars?. *Geology*, 49(11), 1343-1347.

Heaney, P. J., Oxman, M. J., & **Chen, S. A.** (2020). A structural study of size-dependent lattice variation: In situ X-ray diffraction of the growth of goethite nanoparticles from 2-line ferrihydrite. *American Mineralogist: Journal of Earth and Planetary Materials*, *105*(5), 652-663.

Bralower, T. J., Cosmidis, J., Fantle, M. S., Lowery, C. M., Passey, B. H., Gulick, S. P. S., ... & Artemieva, N. (2020). The habitat of the nascent Chicxulub crater. *AGU Advances*, *1*(4), e2020AV000208.

Presentations and Conferences

Invited Oral, "Real-time atomic-scale structural evolution of impurity-doped amorphous to crystalline $CaCO_3$ transformation", ACS Spring National Meeting in San Diego, CA, Mar 23-27, 2025.

Oral, "Constant Wavelength Powder Neutron Diffraction Data Analysis – GUI and Script", TOPAS Workshop, ORNL, Sep 24-27, 2024.

Oral, "Reactor-Based Neutron Diffraction Studies In Earth Mineral Science: Time-Resolved, Non-Destructive, Light Element, Extreme Environment, and More" Geological Society of America Annual Meeting, Anaheim, CA, Sep 22-25, 2024

Invited Oral, "The Growth of Calcite in the Presence of Strontium: In-Situ Measurements Coupled with Multiscale Chemical Imaging", Geological Society of America Annual Meeting, Pittsburg, PA, Oct 15-18, 2023

Oral, “Probing Phase Transformation Kinetics and Mechanism During Calcium Carbonate Formation: An In Situ Atomic-scale Structural Analysis”, ACS Fall National Meeting in San Francisco, CA, Aug 13-17, 2023.

Oral, “The Growth of Calcite in the Presence of Strontium: In-Situ Measurements Coupled with Multiscale Chemical Imaging”, Aug 10, CNMS User Meeting 2023

Oral, “Strontium Incorporation to Single Crystal Calcite Growth”, ORNL 11th Annual Research Symposium, May 18, 2023.

Oral with Award, “The Growth of Calcite in the Presence of Strontium”, ACS Spring National Meeting in Indianapolis, IN, Mar 26-30, 2023

Oral, “The Transformation of Amorphous Calcium Carbonate to Calcite in the Presence of Strontium”, The Geological Society of America 2022 Annual Meeting, Denver, CO, Oct 9-12, 2022.

Oral, “Structural Evolution of Exceptionally Iron-deficient Hematite Nanocrystals as Observed by In-situ Synchrotron X-ray Diffraction”, The Geological Society of America 2019 Annual Meeting in Phoenix, Arizona, 22-25 September, 2019.

Poster, “A Time-Resolved Synchrotron X-ray Diffraction Study of the Transformation From Ferrihydrite to Goethite and Hematite”, Goldschmidt, Boston, Aug 12-17, 2018.