Si (Athena) Chen

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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

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
Advisor: Meihua Chen, Andy H Shen

Technical Skills

- **Structure Characterization Techniques:** Synchrotron X-ray Diffraction (XRD), Neutron Diffraction, Inelastic Neutron Scattering, Atomic Force Microscopy (AFM), Raman Spectroscopy, Fourier-transform Infrared Spectroscopy (FTIR), X-ray fluorescence (XRF), Transmission Electron Microscopy (TEM), 4D Scanning TEM, Scanning Electron Microscopy (SEM), Focused Ion Beam (FIB), Electron Probe Microanalyzer (EPMA), Atom Probe Tomography (APT); Thermogravimetric Analysis/Mass Spectrometry (TGA-MS), Time-of-Flight secondary ion mass spectrometry (ToF-SIMS).
- **Computer Skills:** Python, GSAS I/II, CrystalMaker Suite, DISCUS, VESTA, JADE, Dioptas, MATLAB, Adobe Premiere Pro, Adobe Photoshop, Adobe Ligthroom, FinalCutProX.

Publications

Chen, S. A., Weber, J, Eng, P. J., Stubbs, J. E., Wang, H. W., Chakoumakos, B. C., Liu, T., Spano, T. L., & Stack, A. G. (2023). Structural Mechanism and Kinetics of Amorphous to Crystalline Calcium Carbonate Transformation in the Presence of Strontium. *Proceedings of the National Academy of Sciences*, *in prep*.

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*, *in press*.

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. *Earth and Planetary Science Letters*, *548*, 116476.

Work Experiences

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

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

- 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).
- 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 (TRXRD) (Beamtime proposal awarded at Argonne National Lab).

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.
- 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 (ORNL), 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 neutron diffraction (POWGEN), time-resolved Neutron Diffraction ($WAND^2$) and neutron vibrational spectroscopy (VISION) at 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 SEM and Raman Spectroscopy.
- Quantified mineral inclusions using Raman mapping and proposed mechanism for agate formation.

Honors and Awards

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

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 Award Spring 2018 & Fall 2019
Department of Geosciences, Penn State University.

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

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

China National Scholarship 2012-2013
National Outstanding Student Model (top 1%), Chinese Government.

Leadership and Service

Research co-chair, Oak Ridge Postdoctoral Association (ORPA) Oct 2022 – Present

Geological Society of America Annual Meeting Session Chair Oct 2021 & Oct 2022

Education and Outreach Subcommittee of the Geoscience Synchrotron Steering Committee 2021 – 2022

Mineralogical Society of America Membership Committee Aug 2020 – Present