Daniel Mast

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Biography

Daniel mast is a 2nd year student in the UNLV Radiochemistry Program. He received his Bachelor of Science in Chemistry and his Bachelor of Arts in Mathematics from St. Martin's University in 2013. He was an LLNL CMMD Intern in 2014.

Research

Materials Under Extreme Conditions: Binary Technetium Systems

Observing the properties of matter at extreme conditions of pressure and/or temperature leads to a deeper understanding of physical and chemical properties, especially structure, magnetism, superconductivity, and reactivity. Additionally, pressure and temperature both represent critical parameters in determining the relative stabilities of different structure types, allowing preparation of novel materials which cannot be synthesized at ambient conditions. This project is focused on the behavior of technetium compounds in the kbar to Mbar pressure range and the 300K to 3000K temperature range. A combination of Diamond Anvil Cells (DACs) and laser-heating are used to create the extreme pressures and temperatures where we perform in situ single crystal and powder X-ray diffraction. DAC experiments at conducted at synchrotron sources across the country including the Advanced Photon Source, APS at Argonne National Laboratory, ANL and the Advanced Light Source, ALS at Lawrence Berkeley National Laboratory, LBNL. This work is conducted in collaboration with the High Pressure Science and Engineering Center (HiPSEC) at UNLV and the High Pressure Physics Group at Lawrence Livermore National Laboratory.

Currently, we are exploring the fundamental properties of technetium metal, one of the last elements for which there is no well-defined equation of state. We are also examining TcO_2 and related transition metal oxides with rutile structures. In this family, we have observed multiple temperature and pressure induced phase transition and are working to define the phase diagrams for this collection of transition metal oxides.

Publications, Presentations and Awards

Poster: High Pressure Investigation of Transition Metal Oxides,
2nd Joint Italian Crystallographic Association and Italian Synchrotron Radiation Society (AIC-SILS)

Sept 15th-18th 2014 Florence, Italy

Poster: Equation of State for Technetium by X-ray Diffraction and DFT,
52nd European High Pressure Research Group International al Meeting (EHPRG2014)
Sept 5th – 12th, 2014 Lyon, France

Poster: High Pressure Investigation of Transition Metal Oxides,
LLNL Annual Summer Student Symposium
August 14, 2014 Livermore, CA USA
Poster:Equation of State for Technetium by X-ray Diffraction,
Research at High Pressure, Gordon Research Conference/Seminar
June 21st - 27th, 2014 Biddeford, ME USA

Nuclear Energy University Program-Nuclear Engineering Fellow,
Sept 2014 – Present Las Vegas, NV USA

Malcolm F. Nicol Graduate Scholar,
High Pressure Science and Engineering Center (HiPSEC), UNLV
Sept 2013 - August 2014 Las Vegas, NV USA