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Abstract

Recorded Scholarly Presentation

Major: Chemistry

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Solid-State Crystallization of FeTe and NiSnQ Chalcogenides

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Chalcogenides are compounds consisting of a chalcogen (S, Se, Te) anion and another electropositive element. Iron telluride is a chalcogenide superconductor at low temperatures making it sought after in high-functioning electronic equipment such as Nuclear Magnetic Resonance (NMR) and Magnetic Resonance Imaging (MRI) machines. The importance of having superconductive materials in electronic instruments relates to the property of zero electrical resistance, which superconductors have. Zero electrical resistance refers to an applied current that would exist indefinitely and would not degenerate making their uses electrically efficient. In order to create chalcogenides in crystalline form, a solid-state temperature scheme is implemented where mixtures of chalcogen and metal powders are allowed to reach high temperatures and left to subsequently cool. This cooling process forms the chalcogenide crystals which are then imaged and analyzed using a scanning electron microscope and energy-dispersive X-ray spectroscopy, respectively. The major findings of this research include the discovery of a repeatable and consistent procedure to produce 1:1 iron-tellurium and 1:1:1 Nickel-Tin-Q(S,Se,Te) crystals. For this, a temperature scheme has been developed and tested that produces large, pure crystals of FeTe. Further testing of this scheme allows for small adjustments in the procedure in order to obtain more desirable results. The other goal of this project involves the discovery of a similar temperature scheme for Nickel-Tin-Q(S,Se,Te) crystals which is still ongoing.