



# MSE SEMINAR

Materials Science and Engineering  
Michigan Technological University

Tuesday, April 30, 2013

11:00 am – 12:00 pm

Room 610, M&M Building

## Graduate Student Presentations

### Chemical Enrichment of Iron Sulfides Using Microwave Energy

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#### Abstract

Magnetic iron sulfide ore particles heat rapidly by microwave (MW) irradiation causing decomposition and melting of phases. In open atmosphere, the oxidation reaction of sulfides is a highly exothermic event but under microwave energy the electrochemically driven reaction results in the generation of plasma creating extremely high local temperatures. A melt-flux solution of silicates (*si-mt*) and metal sulfides (*sul-mt*) is produced during the plasma event with a portion of sulfur dissolving into the flux. The *sul-mt* is metal-sulfide  $(\text{Fe,Ni,Cu})_{1-x}\text{S}$  liquid that forms immiscible droplets in the *si-mt*. Upon cooling, *sul-mt* segregates by the initial formation of sub-solidous magnetic monosulfide solution  $(\text{Fe,Ni})_{1-x}\text{S}$  followed by subsequent formation of intermediate sulfide solution  $(\text{Fe,Cu})_{1-x}\text{S}$ . Ferrosphenel ( $\text{Fe}_3\text{O}_4$ ) aids with MW heating of ore particles and encourages formation of  $(\text{Fe,Ni})_{1-x}\text{S}$  from *sul-mt* by magnetic devitrification.

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