Yale Institute for Nanoscience and Quantum Engineering

Friday-September 30, 2016

12:00 to 1:00 p.m.

BECTON SEMINAR ROOM

Light lunch will be served at 11:45 a.m.

Kanani Lee

Department of Geology, Yale University

"Making Metallic Salts at Ultra-High Pressures and Temperatures"

Alkali halide KBr is nominally a wide band-gap insulator and a common calibrant, pressure medium and thermal insulator used in laser-heated diamond-anvil cell experiments. At high pressures (~10-70 GPa) and high temperatures (~2500+ K), transparent KBr becomes opaque. Infrared and Raman spectroscopies suggest a semiconducting nature with possible evolution toward the metallic state upon further compression. Upon decompression, KBr opacity decreases becoming fully transparent at ambient conditions.

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Jan Schroers

Department of Mechanical Engineering and Material Science, Yale University

"Metals Atlas Project"

Metallurgy has advanced slower in the past 50 years than the competing major materials such as electronic materials, polymers, and ceramics. Based on only a handful of base systems, commercial alloys have been incrementally optimized over the last 50 years. In order to enable disruptive advancement in metallurgy, knowledge of the microstructures of available and thus far unconsidered alloys and the dependence of this microstructure on cooling rate is required. The potential range of alloys, just considering chemistry and not processing conditions, is vast and given by the combinations of practical (transition) metal elements. If one considers only ternary systems from the combination of 30 elements with an at least one percent required distinction between alloys, ~25 million alloys are possible compare to the ~100,000 considered thus far. Considering these overwhelming number of alloys with typically used sequential trial-and-error approach is daunting. Despite significant efforts, due to the complexity of microstructure formation, which is a multi-length scale and multi-physics phenomena, theories/simulations have not been able to predict microstructures.

I will first discuss combinatorial approaches using thin film samples, which are well suited for materials with small length scales compare to the film thickness (glasses and nanocrystalline materials). In order to cover a much broader range of materials, we propose a method that fabricates a characterize bulk samples with 1000x faster rate.

Host: Professor Eric Altman