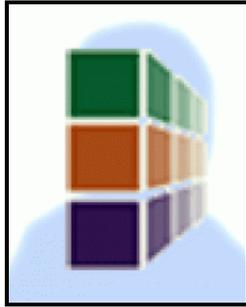


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Special Guest Lectures

Developing High-Temperature Alloys for Fossil Energy Applications**Michael Gao, National Energy Technology Laboratory**Johnston Hall 338
October 21, 2010 - 03:30 pm**Abstract:**

In order to reduce carbon emission from coal-fired power plants, advanced technologies with improved efficiency have been developed such as hydrogen turbines and oxy-fuel turbines. These technologies demand high temperature operation in harsh environment, and thus motivate developing high-temperature high-performance materials. For example, advanced oxy-fuel gas turbine has an inlet temperatures of over 1700oC and will cause blade metal temperatures to exceed 1400oC even with the thermal barrier coating (TBC), which greatly exceeds the temperature limit of current state-of-the-art Ni-base superalloys. National Energy Technology Lab has developed various high-temperature materials for various turbine programs including steels, Ni-based alloys, and refractory metal based alloys. We have adopted an approach that integrates multiscale computer simulations with critical experiments to accelerate new materials design. Physically grounded multi-scale computer design and simulation have been used to predict materials properties so that critical experiments can be designed and limited to the promising alloy compositions. In case of high-temperature alloys, critical properties that must be met include adequate ductility and fracture toughness at low temperatures, high temperature strength and good creep resistance, and good oxidation resistance. Balancing structure-property relationship requires delicate tradeoffs and compromises by manipulating alloy system and composition, microstructure, coatings, and materials processing. During this talk, we will present ongoing research effort implementing this approach to design Cr alloys and ferritic steels using first principles DFT calculations, CALPHAD modeling, microstructure simulations using phase field, and experiments on processing and characterization. Note: 338 Johnston is Access Grid viewing. Live presentation is at 218 J.B. Moore Hall at Southern University