THE MATERIALS SCIENCE AND ENGINEERING DEPARTMENT SPRING COLLOQUIUM SERIES PRESENTS:

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Redox Reactions: A Route to Novel Materials?

The partial reduction of complex oxides of the type MIMIIOx+y can give rise to unique microstructures, comprising interpenetrating mixtures of metallic and ceramic phases. Examples of ceramics which have been shown to be amenable to this approach include $CuAlO_2$ (delafossite) and $CoTiO_3$. Processing of the bulk precursor oxides will be discussed, together with the influence of reduction conditions on the resulting ceramic metal structures. Cs-corrected high-angle annular dark field (HAADF)-STEM images reveal novel aspects of the composite structure at the atomic scale. The work on the Co-Ti-O system also showed that pseudo-single crystals of the pseudobrookite compound $CoTi_2O_5$ could be synthesized by solid-state reaction within a duplex grain mixture of $CoTiO_3$ and TiO_2. A novel growth mechanism was identified whereby a single crystal $CoTi_2O_5$ front advances simultaneously along multiple $CoTiO_3$ /TiO_2 diphasic boundaries. The single crystal domains were composed of subgrains; differences in the subgrain size and misorientation were related to the growth mechanism and the initial grain size of the duplex $CoTiO_3$ - TiO_2 mixture.

The reduction of mixed oxide powders is also a novel, viable route for the processing of bulk metallic alloys. Preliminary work describing the application of this process to the synthesis of so-called high entropy alloys (also known as multi-principal element alloys) will also be discussed.

Dr. Chan received her B.Sc. (First Class Hons.) and Ph.D. degrees from the Dept. of Materials Science & Technology at Imperial College (University of London). She joined the Lehigh faculty in 1986, and subsequently took an 18-month leave of absence at the National Institute of Standards and Technology, where she worked in the Mechanical Properties Group of the Ceramics Division. Dr. Chan returned to Lehigh January 1988, and was promoted to the rank of Associate Professor with tenure in 1991, and to the rank of Full Professor in 1995. Dr. Chan served as Chair of the Department of Materials Science and Engineering 2006 - 2016. Dr. Chan is the author of over 190 publications, 165 contributed talks, and given over 110 invited presentations. US Patents Issued: 5. Total journal citations (Google scholar): > 7,088, h-index ~ 42. Her research interests include: 1) Application of reactive processing to fabricate unique ceramic/metal structures, 2) Processing, properties and advanced characterization of high entropy alloys, 3) Mechanical behavior of ceramic composites, 4) Role of interfacial chemistry in determining the elevated temperature mechanical behavior of ceramics.

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