DMSE Semester Colloquia Series

Tuesday, January 15, 2019
White 411 at 4:00pm

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Identification of Structural Instabilities, and their influence on Microstructural Evolution, in Titanium Alloys

The subject of microstructural evolution in metastable beta titanium alloys has attracted much attention recently. Thus, compared with conventional microstructures in alpha/beta Ti alloys, typically involving fairly coarse lamellae of the alpha phase in either the colony or basketweave arrangement depending on heat treatment conditions, various size scales of refined intragranular alpha microstructures can be produced in metastable beta Ti alloys. In this current research, three different size scales of alpha microstructure, termed *refined* alpha, *more-refined* alpha and *super-refined* alpha microstructures, have been characterized in the same metastable beta Ti alloy, Ti-5553. These various distributions have been produced by exploiting the influences of compositional and/or structural instabilities on the transformation, using various non-conventional transformation pathways. At first, aberration-corrected (S)TEM has been employed to identify and characterize these structural instabilities. Then, their role on microstructural evolution has been determined. Thus, the *refined* alpha microstructure is formed by the mechanism of pseudo-spinodal decomposition, involving thermally-activated compositional fluctuations about the appropriate $C_o(T)$ composition within the beta matrix. Metastable phases, such as the omega phase and *bcc* structure beta-prime phase, can also alter the local concentration and/or structure and therefore potentially affect subsequent alpha precipitation. The *more-refined* and *super-refined* alpha microstructures are formed by exploiting this metastability, specifically the indirect and direct influences of the pre-formed, uniformly distributed metastable omega phase in a beta phase matrix. The formation mechanisms of these various forms of ultra fine alpha microstructures will be compared and contrasted in terms of these nano-scale compositional a

nd/or structural instabilities in the beta phase matrix in metastable beta titanium alloys.

Biography:

Hamish L. Fraser

Dr. Fraser graduated from the University of Birmingham (UK) with the degrees of B.Sc. (1970) and Ph.D. (1972). He was appointed to the faculty of the University of Illinois in 1973 (Assistant, Associate and Full Professor), before moving in 1989 to the Ohio State University (OSU) as Ohio Regents Eminent Scholar and Professor. He was appointed as a Senior Research Scientist at the United Technologies Research Center from 1979-1980. He has also been a Senior von Humboldt Researcher at the University of Göttingen, a Senior Visitor at the University of Cambridge, a

visiting professor at the University of Liverpool, and he spent a sabbatical leave at the Max-Planck Institut für Werkstoffwissenschaften in Stuttgart. He has been an Honorary Professor of Materials and Technology at the University of Birmingham since 1988. In 2014, he was recognized as an Honorary Professor at the Nelson Mandela Metropolitan University in Port Elizabeth, South Africa. He is also an Adjunct Professor at Monash University in Australia and at the University of North Texas. At present, he serves as Director of the Center for the Accelerated Maturation of Materials (CAMM) at OSU. He has been a member of the National Materials Advisory Board and the US Air Force Scientific Advisory Board. He has consulted for a number of national laboratories and several industrial companies. He is a Fellow of TMS, ASM, IOM^3 (UK), and MSA. He has published over 410 papers in scholarly journals, and given over 320 invited presentations. He has graduated over 50 doctoral students and 36 students graduating with the degree of M.S.