

UNIVERSITY OF CALIFORNIA, IRVINE

## THE DEPARTMENT OF MATERIALS SCIENCE AND ENGINEERING



Is Proud to Host a Seminar by:

**PRESIDENT & CEO**

**ROBERT W. HAYES**

Metals Technology Inc

Northridge, California

**Thursday, January 12, 2023**

**2:00-3:20 PM**

**Location:**

**McDonnell Douglas Engineering Auditorium**

## **CREEP OF POLYCRYSTALLINE NI-BASE SUPERALLOYS AT INTERMEDIATE TEMPERATURES**

**Abstract:** Polycrystalline Ni-base superalloys derive their strength and high temperature creep resistance from the precipitation of the ordered  $g'$ ,  $g''$  or the coprecipitation of both phases depending on the specific alloy. Under long term creep at intermediate temperatures, the presence of these strengthening particles in the microstructure lead to complex dislocation - particle interactions resulting in numerous fault related dislocation - particle shearing processes. The same complex shearing processes appear to occur in both high and low volume fraction  $g'$  alloys. Also accompanying the complex dislocation - particle shearing, diffusion mediated processes also take place which have a strong effect on creep rate. The specific deformation structures which develop are a strong function of  $g'$  distribution and size which dictates the size of the matrix  $g$  channels. Cooling rate from the solution temperature dictates the strengthening precipitate structure. Examples of these deformation processes are presented and discussed. Microstructure characterization techniques have advanced significantly over the past few decades allowing the observation of structural features which have been suggested but not resolvable. Techniques such as HRTEM with HAADF imaging allows for specific dislocation and fault identification. The presentation will conclude with some discussion of the effect of environment on deformation characteristics of these Ni-base superalloys.

**Bio:** Mr. Robert Hayes is currently the President and C.E.O. of Metals Technology Inc. He obtained his B.S. diploma in Engineering Technology from West Coast University in 1985 with the thesis work on the formation of alloy carbides during ausforming. Mr. Hayes started his career at Metals Technology in 1976 working in several roles spanning from mechanical testing, metallography, and operations, to fundamental materials problems in metals and alloys that led to a number of publications in international journals. From 1986 to 1988, he worked at Rocketdyne division of Rockwell International Corp. on a DARPA-funded program to develop more advanced high thermal conductivity Cu alloys for Space Shuttle Main Engine (SSME) program. Upon return to Metals Technology in 1988, Mr. Hayes worked on the creep behavior of various alloys in collaboration with Rockwell International Science Center, the Ohio State University, and with Prof. Enrique Lavernia and Prof. Jim Earthman at University of California-Irvine, leading to a number of journal publications. Since 2000, Mr. Hayes took the leadership role as the President and C.E.O. of Metals Technology.