UNIVERSITY OF BIRMINGHAM

Module Name:	**Intermetallics, Metal Matrix Composites and Ceramic Matrix Composites**
Module Code:	**04 17683**
Presenter(s):	**Professor Paul Bowen (Birmingham) + Professor Howard Stone (Cambridge)**
Credit Rating:	**10**
Venue:	**School of Metallurgy & Materials, University of Birmingham**

Description:

This module will give a detailed analysis of the development and use of strong solids (Intermetallics and ceramics), metal matrix composites (fibre and particulate) and ceramic matrix composites (fibres and particulates) in structural applications. Design limitations and potential will be a particular focus of the module.

The units will cover the following:

Design driven materials development: detailed description of fibre reinforced MMCs and CMCs; particulate MMCs and CMCs; intermetallic alloys.

Principles of damage tolerance: crack-tip shielding, compressive residual stress, crack deflection, weak interfaces, fibre bridging.

Ceramics and CMCs: mechanisms of fatigue; environmental concerns; matrix cracking stress as a design limit.

v) Titanium aluminides: usable stress range, optimisation of microstructure, micromechanisms of failure, mechanical properties, chemistry; interlamellar failure.

MMCs: aluminium particulate MMCs: titanium fibre reinforced MMCs. Potential applications. Fundamental issues: fibre volume fraction, fibre strength and fibre degradation: effects of test temperature and environment; matrix optimisation and interfacial properties. Fibre processing. Composite processing. Extrinsic factors: selective reinforcement, fibre ends, crack size and crack shape. Scaling up results on testpieces to components.

Learning Outcomes:

By the end of the module the student should be able to: Appreciate potential and limitations of current generation ceramics, CMCs, MMCs and Intermetallics for use in load bearing applications; Understand principles of crack-tip shielding (toughening) in materials of limited plasticity; Understand micromechanisms of fracture and fatigue in ceramics, intermetallics and composites; Appreciate the influence of microstructure on the fracture and fatigue resistance of titanium alimindes; Understand the phenomenon of fibre bridging and how it can be optimised; For fibre reinforced TiMMCs to distinguish between intrinsic materials factors and extrinsic geometrical factors in controlling the life of components and testpieces under fatigue loading.

Assessment:

Two hour open book examination during course presentation.