Ping Xiao, The University of Manchester

Title: "Characterisation techniques for investigating thermal barrier coating and environmental barrier coating failure"

Abstract:
Materials characterisation plays a crucial role in developing thermal barrier coatings (TBCs) and environmental barrier coatings (EBCs) for gas-turbine engines. The failure of thermal barrier coatings and environmental barrier coatings is influenced by a complex interdependence of microstructure, residual stress, and thermomechanical properties. Validating our mechanistic understanding of each of these factors that contribute to failure requires a selection of suitable characterisation techniques. Presented in this talk are characterisation techniques that have advanced the understanding of thermal barrier coating and environmental barrier coating failure. Examples of characterization studies at University of Manchester will be given to present on 1) how electron microscopy together with optical microscopy and X-ray tomography can be used to examine degradation of TBCs and EBCs; 2) 4 point bending coupled with micro-mechanical study have been used to measure mechanical properties of TBCs; 3) Raman spectroscopy, XRD and synchron X-ray diffraction have been explored to examine residual stresses in TBCs and EBCs. Targeted coating development that is both effective and efficient depends on these characterisation techniques to obtain superior coatings with improved performance and lifetime.

Biography:

Ping Xiao currently holds the Rolls-Royce/Royal Academy of Engineering Research Chair in Advanced Coating Technology, maintaining a collaborative relationship with Rolls-Royce plc spanning over two decades. He has made a significant impact on introduction of TBCs into service in aero-engines. Presently, Xiao is closely engaged with Rolls-Royce to develop environmental barrier coatings for aero-engines, aimed at achieving higher operational temperatures and lighter components. His work has garnered international recognition, with features in The Economist and the American Society of Mechanical Engineers website. In 2017, he was interviewed by the Canada Business Network. Appointed by the UK Government's BEIS in 2019, Xiao serves as the UK representative on ceramics for the Generation IV Nuclear Reactor International Forum (GIF), interacting with representatives from the USA, EU, Japan, Canada, Australia, China, and the UK. Since 2020, Xiao is Chair of the Surface Engineering Division of the Institute of Materials, Mining, and Minerals (IOM3) in the UK. In 2024, he has been awarded the Institute of Materials, Minerals & Mining (IOM3) Tom Bell Surface Engineering Medal in recognition of excellence and outstanding contribution in surface engineering.