Loughborough University

Speaker 3

Evaluation of metallurgical risk factors in post-test, advanced 9%Cr creep strength enhanced ferritic (CSEF) steel

Xiyu Yuki Zhang

SPEAKER / LEAD AUTHOR:
Xiyu Yuki Zhang

INSTITUTION:
Loughborough University

OTHER AUTHORS:
Dr Mark Jepson, Loughborough University
Dr Simon Hogg, Loughborough University

ABSTRACT:
9% Cr steels are widely used in the design and fabrication of thick section components in a commonly combined cycle or coal-fired applications and for working temperatures of 600~650°C. This family of materials possesses a martensitic microstructure stabilized by precipitates. The presence of nitrides, inclusions, or evolution of second-phase particles may increase the metallurgical risk. The chemical composition and microstructural evolution of 9% Cr steels contribute to thermal stability and long-term performance. To fully appreciate the development of damage in these steels, it is necessary to link the pre- and post-test conditions, evaluate damage in the parent metal, develop procedures that provide consistency of results, and obtain statistically relevant results. Large Ta-containing particles or inclusions in the 9% Cr steels may have a detrimental effect on its creep performance, as they may act as the preferred sites for cavity nucleation. The evolution of the Ta-containing phase as a risk factor for the creep strength of the 9% Cr steel has been tracked and quantified using a variety of correlative characterization approaches. Utilizing focused ion beam microscopy and two-dimensional electronbased microscopic characterisation, three-dimensional tomography has confirmed the strong relationship between creep cavities and Ta-containing phases from the early stages of creep.