Society of Engineering Science 51st Annual Technical Meeting

1–3 October 2014

Purdue University, West Lafayette, Indiana, USA

Microstructural variables that affect the fatigue crack initiation location in a nickel-base superalloy at 800°C

Shyam, Amit, shyama@ornl.gov; Roy, Shibayan; Dryepondt, Sebastien; Maziasz, Phil, Oak Ridge National Laboratory, United States

ABSTRACT

Fatigue tests under high cycle fatigue loading conditions were performed for Haynes 282® superalloy at 800°C. Fractographic examination of failed specimens indicated that, under the same stressing parameters, the longer life specimens formed fatigue cracks that initiated at a subsurface location, whereas the shorter life specimens formed cracks that initiated near the specimen surface. The microstructural source of variability in the fatigue crack initiation location will be described in this presentation. Larger grains or grain clusters with small misorientation between neighboring grains were identified to be crack initiation locations. It was concluded through electron backscattered diffraction characterization of the material microstructure that the probability of surface crack initiation could be predicated upon the probability of locating a critical microstructural neighborhood in the surface of the specimen. Implications of the analysis for the calculated variability of fatigue lives will be discussed by comparing the predictions with experimental fatigue lives. Research sponsored by the U.S. Department of Energy, Office of Fossil Energy, Crosscutting Research Program.