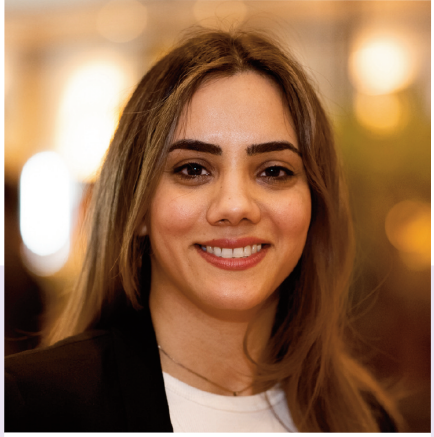
Brunel University London

Speaker 7

Correlation between electrical resistivity, ultrasonic measurements and microstructural changes in SS316 under high-cycle fatigue



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ABSTRACT:
Most of the metal's failure happens because of the fatigue which is associated with metal that is subjected to cyclic loading over time. Undetected fatigue damage can lead to catastrophic failures in critical components like those in aerospace, automotive and infrastructure. Early detection enables timely maintenance, enhances safety, reduces costs and supports the circular economy by minimizing resource extraction and promoting efficient resource utilization. Fatigue typically progresses through stages such as pre-crack nucleation, crack formation and crack growth. While many techniques detect fatigue damage after crack formation, early detection during the pre-crack nucleation stage remains less explored. This stage involves increased dislocation density, changes in dislocation features and slip band formation, which act as crack initiation sites. Non-destructive testing (NDT) methods, including electrical resistivity and nonlinear ultrasonic testing, effectively identify early fatigue damage. Significant changes in electrical resistivity and nonlinear parameters were observed at three distinct stages before 10% of fatigue life of SS316, validated by TEM and destructive methods.