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Structural and Microstructural Investigation into Causes of Rail Squat Defects and Their Correlation with White Etching Layers

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Abstract : Squats are a type railhead defect related to rolling contact fatigue (RCF) damage and are considered serious problem affecting a wide range of railway networks across the world. Squats can lead to partial or complete rail failure. Formation mechanics of squats on the surface of rail steel is still a matter of debate. In this work, structural and microstructural observations from ex-service damaged rail both confirms the phases present in white etching layer (WEL) regions and relationship between cracking in WEL and squat defect formation. XRD synchrotron results obtained from the top surfaces of rail regions containing both WEL and squat defects reveal that these regions contain both martensite and retained austenite. Microstructural analysis of these regions revealed the occurrence cracks extending from WEL down into the rail through the squat region. These findings obtained from field rail specimen support the view that WEL contains regions of austenite and martensitic transformation product, and that cracks in this brittle surface layer propagate deeper into the rail as squats originate and grow.

Keywords : squat, white etching layer, rolling contact fatigue, synchrotron diffraction
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