Multiscale characterization of White Etching Cracks (WEC) in a 100Cr6 bearing from a thrust bearing test rig - DTU Orbit (16/12/2018)

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A common cause for premature bearing failures in wind turbine gearboxes are the so-called White Etching Cracks (WEC). These undirected, three-dimensional cracks are bordered by regions of altered microstructure and ultimately lead to a cracking or spalling of the raceway. An accelerated WEC test was carried out on a FE8 test rig using cylindrical roller thrust bearings made of martensitic 100Cr6 steel. The resulting WECs were investigated with several characterisation techniques. Ultrasonic measurements showed the WEC were mainly located in the region of the overrolled surface in which negative slip occurs, which agrees with hypotheses based on an energetic approach for a prognosis. SEM orientation contrast imaging of the area around WEC revealed an inhomogeneous structure with varied grain sizes and a large amount of defects. Microstructure characterization around the WEA using EBSD showed significant grain refinement. Atom probe tomography showed the microstructure in the undamaged zone has a plate-like martensitic structure with carbides, while no carbides were detected in the WEA where the microstructure consisted of equiaxed 10 nm grains. A three dimensional characterisation of WEC network was successfully demonstrated with X-ray computerized tomography, showing crack interaction with unidentified inclusion-like particles.

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