Jithin Abraham Mathews
PhD candidate

Tel:
+31 (0) 687840143

E-mail:
J.AbrahamMathews@tudelft.nl

Research topics:

Case carburized steels;
Irregular white etching and butterfly cracks;
Upstream processing routes and its impact on non-classical rolling contact fatigue;

Influence of Upstream Processing on Wind Turbine Main Bearings: Microstructure and Performance

Project objectives:

The project aims to quantitatively describe the effects of upstream process parameters on microstructure, and consequently on material performance under rolling contact fatigue of case-carburized steels.

Project background:

Main shaft bearings are one of the most prominently loaded elements on a wind turbine. Despite designed for a lifetime of 20+ years, pre-mature failures in the form of white structure flaking, spalling and macro-pitting have plagued the wind power industry as they form much earlier than anticipated, during bearing operation. Heat treatment methods like case-carburization are effective, to a certain extent, in sustaining dynamic loads. Though case-carburized bearing versions also show pre-mature failures, their lifetime is strongly related to thermal treatment parameters. This has opened up a new perspective on failure investigation which will quantify those decisive microstructural aspects inherited from upstream routes, with regards to failure.

Fig 1: ***Spallings at the inner ring in regions of highest contact pressure.***

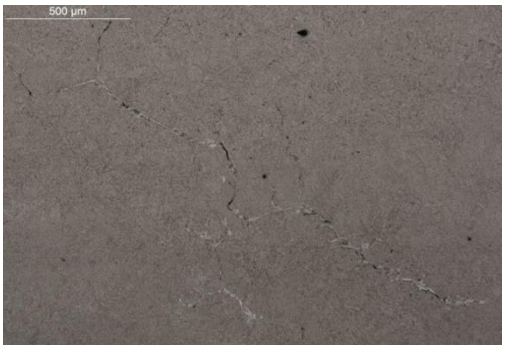

Fig 2: ***Irregular white etching cracks in the underlying microstructure of a spalled bearing.***

Future work:

The focus of this work will be on experimental observations of microstructure development and failure mechanisms. Experimental results will be analysed to relate processing routes and microstructure with performance.

Failure investigation will be performed on large double row tapered roller bearings with diameter up to 4 meters. In order to find the relation between failures and steel processing routes, microstructural aspects from multiple processing routes will be characterized. They are, among others, grain size, morphology, texture, internal stress, dislocation density, segregations, non-martensitic transformation products etc.

Recent activities:

- Literature survey.
- Qualitative analysis of microstructural evolution during two different routes of carburization heat treatment.