

Formation and characteristics of white etching layers on austenitic steels

Introduction

White etching layers (WEL) form due to rapid heating and cooling of a material. In railway applications, the formation is commonly due to short-term sliding of the wheel on the rail. It is also known that WEL can form under very large and rapid material deformations.

The formation of WEL is believed to promote the formation of rolling contact fatigue cracks in the rail. This is a phenomenon that is costly to mitigate and may lead to safety concerns.

The current study on the formation and characteristics of white etching layers on austenitic steels. For the more common pearlitic rail steel the topic is fairly well investigated, whereas knowledge is lacking on whether WEL initiation in austenitic steels is an issue. Rail cracks are for example seen in Mn-steels in crossings, but the initiation point and the behaviour of the damaged material layer is unclear.

Further, there is a lack of understanding on deformation induced WEL. The project will make an overall investigation into this.

The study will be supported by voestalpine railway systems, which is the global market leader for railway infrastructure system solutions.

Content of the project

The study should include:

- General literature study on the topic
- Comparison of the formation of thermal and deformation induced WELs on pearlitic and austenitic steels (lab experiments)
- Characterization of the changed material properties in the damaged zones

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Materials science & strength of materials
IMS/M2

Student competencies

Basic courses in Materials Science, Materials Technology or similar. Basic courses in Solid Mechanics. Preferably at least one student from Materials Engineering master programme, and at least one student who have taken the Fatigue and Fracture course.

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