Miniatured wheel-rail contact in lubricated conditions

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Abstract

KEYWORDS
Wheel-rail contact, Rolling contact fatigue, Lubrication

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Wheel/rail contact management is one of the main challenges in railways and impact both operation performances, cost and maintenance. This contact is fundamentally multi-parameters with factors coming from very distinct fields such as rolling stock nature, track geometry, traffic conditions, weather... In order to further comprehend the impact of a specific parameter, laboratory scale testing is a typical way to isolate one or a set of parameters. In this respect, both low scale (pin-on-disk, twin disk...) and full-scale benches (Deutsche Bahn's rig test A, Grenoble's Wheel...) are possible solutions, each of them proposing distinct advantages and drawbacks.

TriboRail test bench, developed during this project, lies between these two scales and offer representative contact conditions at 1/10th scale, with considerations for both materials solicitation and railways dynamics. Compared to full-scale tests benches, the test duration, cost and maintenance complexity are significantly lowered, which allows more systematic investigations.

The main objective of this work is to study Rolling Contact Fatigue (RCF) defects formation in a tight curve solicitation, depending on lubrication conditions. Contact conditions are defined using as reference an actual track localization where defects are often to be found. Contact conditions are monotonic, which maximizes RCF defects occurrence and, hereby, lower test duration. The impact of lubrication on wheel-rail contact is followed *in-situ*, in particular by friction coefficient evolution, as well as characterized after testing, by investigating wear and fatigue by surface and microstructural analyses. The impact of lubrication conditions on both wear and RCF resistance are then discussed in order to quantify its impact on rail service life.

Acknowledgments

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The authors would like to gratefully thank Dr. H. Chollet, Université Gustave Eiffel - GRETTIA for initial TriboRail test bench conception. This work is part of LubRail project, co-founded by SNCF-Réseau.