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EXPLORING TIRE/RAIL FRICTION: CONTAMINATED CASES

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ABSTRACT

This study aimed to enhance our understanding of tire/rail friction in contaminated scenarios, to highlight the importance of surface texture for effective control of friction in different conditions. The insights to be gained will provide valuable guidance for ensuring safe and efficient travel on railway tracks

Indeed, in the pursuit of innovative transportation solutions, adapting automobiles for travel on railway tracks presents promising prospects for transportation mode versatility [1]. However, the success of this transition relies heavily on understanding and managing the complex interactions between tires and rails. Particularly, comprehending the evolution of the tire-rail skid resistance (related to the tire-rail friction) in degraded contact conditions, such as rainy weather or surface contaminated with car oil, is crucial for ensuring safe and efficient travels on railways tracks [2-3].

This study investigates the influence of contamination on the friction between tires and rails. Laboratory-based simulations focused on two sets of circular steel samples: (i) surfaces with grooves and shot-blasting and (ii) surfaces solely subjected to shot-blasting (Fig.1)

Surface topography was analyzed using ISO 25178 parameters, and the coefficient of friction (COF) was determined through a pin-on-disc test conducted on a tribometer, employing rubber commonly used in the Dynamic Friction Test (DFT).

Fig.1 (Left) surface with grooves and shot-blasting (Right) surface solely subjected to shot-blasting

Three protocols were employed to simulate degraded contact scenarios: the first involved wetting; the second included wetting at the beginning with subsequent water jet applications every two minutes; and the third incorporated a grease film and a water jet at the start, followed by a water jet every two minutes throughout the test duration.

It was observed, for the first set of samples, that contaminants reduced the COF, and grooves did not assist in wet contact conditions (Fig. 2). Grooves, in fact, posed a risk of moisture reservoirs, continuously supplying water to the contact area during sliding, especially in the case of non-protruding grooves.

Concerning the second set of samples, water had a negligible effect on the COF during pure sliding movements. Surface texture characteristics proved to be the primary determinant of friction control, regardless of water presence. Consequently, the optimal selection of surface texture parameters emerged as an effective strategy for COF management, particularly under wet contact conditions.

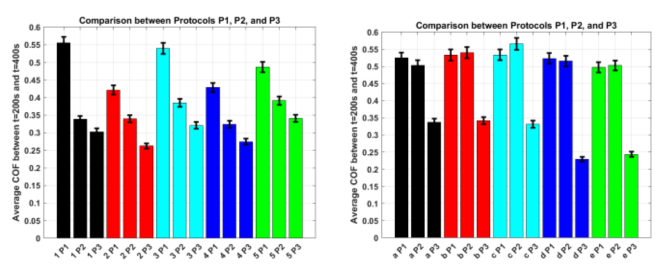

Fig.2 Comparison between protocols 1, 2 and 3; (Left: first samples set; Right: second samples set)

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