Tribological and surface-chemical investigation of rail conditioners used for top-of-rail friction management

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The recent assessment produced by the Intergovernmental Panel on Climate Change (IPCC) highlights the need for mitigating the impact of the transport sector on the emission of greenhouse gases (GHGs). At least in the short and medium term, this implies a substantial shift from road and air to the more energy-efficient rail transport. The current trend towards more demanding operative conditions in rail transport is thus likely to accelerate over the next decades, which in turn triggers the search for novel practices to reduce maintenance costs, while guaranteeing passenger safety and minimizing environmental issues. The management of friction between the wheel and the rail is crucial to the development of these practices. A variety of commercial products has been introduced with the purpose of adjusting friction to values that are considered optimal for safe operation and damage prevention. The composition of *top-of-rail conditioners (RC)* can vary substantially, ranging from oil-based formulations or greases, to water-based (drying) products and solid RCs. While several studies seem to indicate beneficial effects of RCs on friction management and damage prevention, the scientific knowledge is rather fragmented, especially concerning the potential impact on rolling-contact fatigue. Moreover, the role of the application method and the effect of environmental factors on the tribological behavior of RCs lubricated pairs are two aspects that require a more exhaustive analysis. In this study, we consider the effect of commercial products and laboratory formulations on the tribological behavior of rolling contacts between steel counterparts. The variation of the friction response with time, slide-to-roll ratio and environmental conditions is presented together with the results of surface-chemical analysis of tribostressed counterparts.

Keywords: wheel-rail interface, top-of-rail friction management, wear, rolling contact fatigue, sustainability

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