Tribological characterisation of brake block materials for railway applications under dry and icy conditions

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For several years, the Swedish railway has observed incidents where a significant and sudden loss of brake performance occurs in winter conditions on train wagons equipped with tread brakes and composite brake blocks (CBB). The problem is more significant at temperatures below - 15 °C and in combination with fly-off snow. There is a danger that the number of incidents will further increase when more wagons equipped with composite brake blocks are introduced in Sweden. There is a necessity to establish test methods that can be used for evaluation of new developed brake materials under well-controlled laboratory conditions, to facilitate an understanding of the friction mechanisms between brake block and wheel. The aim of this work was to characterise the tribological behaviour of different CBB materials at room temperature (RT) and -15 °C, as well as under dry and icy conditions. Tribological tests were conducted in a block-on-ring configuration, in a dry contact and at room temperature, and at sub-zero temperature using a pin-on-disc configuration in dry and icy conditions. The study focused on understanding the materials interaction and their friction and wear behaviour with and without the presence of ice, as well as the effect of temperature on the tribological response. Three different types of brake block materials were studied; a pearlitic cast iron with graphite nodules used as a reference material, two organic CBB materials and two sintered CBB.

The test methodology was able to highlight differences in the tribological response of the different materials and their dependence with temperature. The sintered CBB showed a similar friction coefficient to that of the reference cast iron material, both at room and at low temperature. This was also seen when ice was formed at the surface at -15 °C. When compared to the organic CBB, the sintered materials showed a higher coefficient of friction. In terms of wear, the sintered CBB underwent higher wear and also produced higher wear on the counter wheel-material compared to the organic CBB. Cast iron brake material underwent low wear, but resulted in more wear of the counter material compared to the organic CBB. The results suggest that sintered CBB can have improved performance under winter conditions compared to the organic CBB.

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