The Restraint Effect of a Scoring Phenomenon in an Abrasive Block Used for Cleaning Wheel Treads Using Changed Control Techniques

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1. Introduction

Wheel tread cleaners are installed on high-speed vehicles to press adhesion-intensifying abrasive blocks onto the wheel tread for the purpose of improving adhesion. The abrasive block plays various roles: to clean the wheel tread, to prevent wheel slip and skid, to improve sensitivity for operating track circuits and to reduce running noise. Recently, however, abnormal noise has been generated by scoring fragments adhering to the abrasive block or by concave wear which is caused by the scoring phenomenon on the wheel tread. These problems have been observed on vehicles of a certain type running on lines where single-step-brakes are applied. A vehicle running test was conducted using a control technique developed in the course of tests for reproducing scoring fragments. The next part of this description introduces the results of a comparison between the developed control technique and the present control technique with respect to the restraint effect of the scoring phenomenon which reduces the formation of scoring fragments.

2. Scoring fragments in present circumstances

Figure 1 illustrates the abrasive block of an actual vehicle and some scoring fragments. The scoring fragments to the portion corresponding to the rolling width of the wheel tread can be observed (Fig. 1(a)). From this Fig., the formation of scoring fragments is assumed to be related to a certain substance intervening between the wheel and the rail in different rolling conditions. Wedge-like cut metal pieces can be observed on the surface, with a melting mark or high-temperature oxidation visible on the reverse surface (Fig. 1(b)). The scoring fragments are assumed to have been formed after the surface layer of the wheel tread starts to peel in the high-temperature environment.

3. Reproduction test on a test stand

Figure 2 illustrates a dynamo test stand. Dry and wet conditions are combined with the presence/absence of sample sprinkling to simulate the conditions of the actual vehicle running environment. Powdered materials such as cement, rail rust, vehicle sludge, alumina, quartz sand and white sand were used as samples to be sprinkled onto the wheel tread to provide the same conditions, in tunnels, on open sections and on new lines, an adhesion-intensifying injection device is operated on certain sections, for examples. Both single-step-brakes and conventional multi-step-brakes were used to generate different braking patterns.

In the single-step-brakes test to reproduce the actual vehicle condition, scoring fragments were observed both in wet conditions and in wet conditions when samples of powdered material were sprinkled on the wheel. In particular, when quartz sand was being sprinkled on to the wheel surface, scoring fragments similar to those observed in the actual vehicle were formed (Fig. 3(a)). In the multi-step-brakes test conducted under the same conditions, scoring fragments smaller than those observed in the previous condition were formed (Fig. 3(b)). The intermittent operation of the abrasive block, which occurs when the multi-step-brakes is used, is assumed to provide the restraint effect. Then the single-step-brakes was subjected to both continuous control, as currently used, and intermittent control with a combination of 20-second operation and 10-second release. A comparison between the two types of control was made with respect to the wheel tread roughness contributing to the adhesion coefficient. Comparison of the results shows the same wheel tread roughness arising from intermittent control as from continuous control.

4. Running test

A comparison was made between continuous control and intermittent control applied to the leading vehicle (Car No.1) on each of the train set which is likely to generate more scoring fragments. These train sets had been subjected to running tests using single-step-brakes in the winter or during the season when scoring fragments are most often observed (Fig. 4). Under the intermittent control conducted in the test, both the operation period and the release period were corrected to 17seconds to take account of the operational characteristics of the abrasive block used on the actual vehicle. The test result shows that the intermittent control effectively suppresses formation of scoring fragments while keeping the equivalent adhesion-intensifying effect (Fig. 4(b)).

5. Conclusion

Based on the results of the running tests, intermittent control is considered as one of the optimum techniques to suppress the scoring phenomenon while keeping the adhesion-intensifying effect. Application of the control technique to other types of vehicle will be further examined by evaluating adhesion and the restraint effect throughout the year.

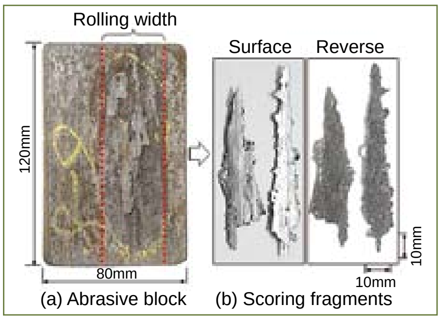

Fig. 1 Abrasive block and scoring fragments of a vehicle

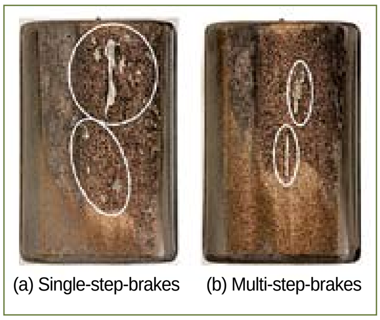

Fig. 3 Scoring fragments formed during laboratory tests

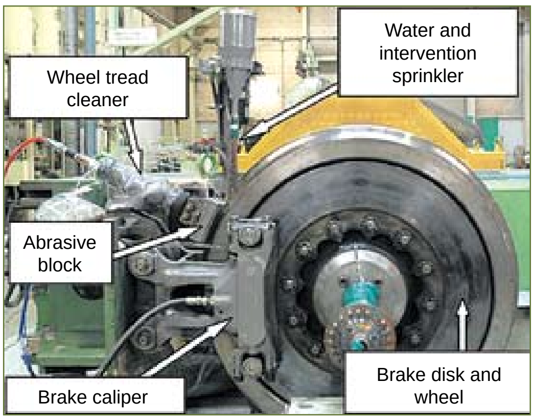

Fig. 2 Dynamo test stand in a laboratory

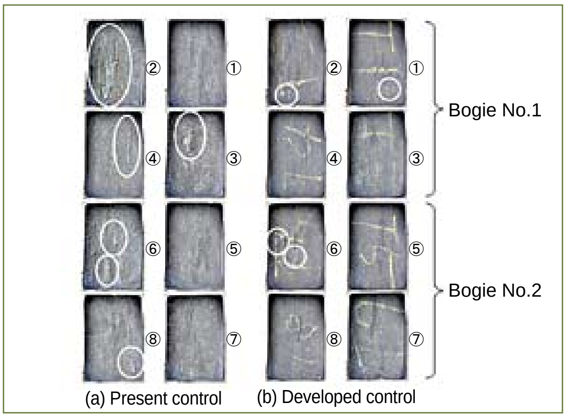

Fig. 4 Scoring fragments formed in a running test