Development of a New Pantograph Contact Strip for Ultrahigh-Speed Operations

Hiroshi TSUCHIYA
Senior Researcher, Frictional Materials, Materials Technology Division

With Shinkansen trains traveling at even higher speeds, it is expected that wear rates of pantograph contact strip will increase significantly, because of such factors as the stronger collecting current and the greater number of arc discharge generated during contact loss. Any development of a new contact strip material for effective use at an ultrahigh-speed (speeds above 300 km/h) would have to achieve better heat resistance and lubricating capability by improving iron-based sintered alloy which is used in high speed trains.

Our objective is to develop a new contact strip material offering more effective performance at ultrahigh-speed. Wear characteristics of a new contact strip material which contains tungsten were compared with those of the unleaded sintered alloy contact strip that had already been developed. A high-speed wear tester for current-collecting materials, which permits evaluation of wear behavior under simulated ultrahigh-speed conditions (exceeding 300 km/h), was used to evaluate the wear characteristics of each contact strip material.

By conducting sliding wear tests at a speed of 400 km/h, using the high-speed wear tester for current-collecting materials (see Fig. 1) under electric current, it was confirmed that the addition of a tungsten-based material as a hard, heat-resistant metallic component improved arc discharge resistance significantly, and made it possible to achieve wear resistance superior to that of a conventional material (see Fig. 2).

The developing material is higher in density than that of conventional material because tungsten is heavy, so the pantograph incorporating the developing material would be heavier than one with a conventional material. In addition, a contact strip incorporating the developing material would cost more, because tungsten is expensive. We are planning

to develop better contact strip materials which contain optimal tungsten volume to maintain the excellent wear characteristics, and reduce the cost and the weight.

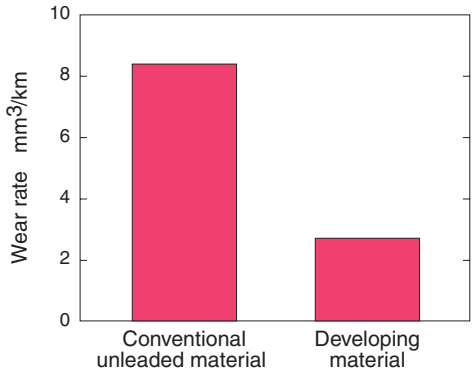
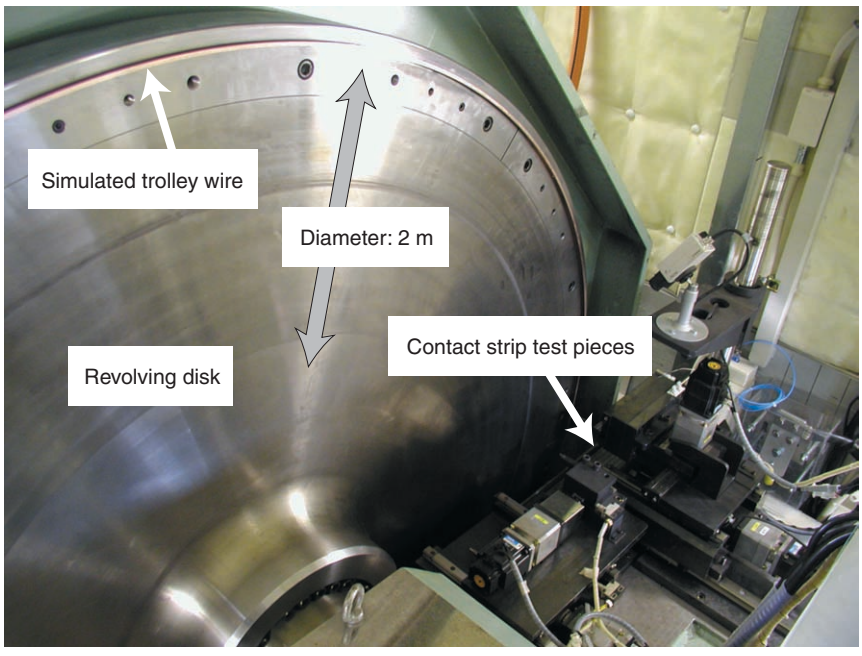


Figure 2. Comparison of wear resistance at 400 km/h



Principal test conditions

(1) Speeds:
300 km/h, 400 km/h

(2) Current:
50 A/strip

(3) Contact loss rate:
Approx. 30% to 70%
(measured by voltage drop)

(4) Applied force:
49N

Figure 1. High-speed wear tester for current-collecting materials, and principal test conditions