

Study On the Influence of Brake Speed on Friction and Wear Properties of High-Speed Iron Brake Materials under High Humidity Condition

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Extended Abstract

With the inauguration of the Beijing-Guangzhou high-speed rail line, the extremely humid environment has posed a significant challenge to the development of China's high-speed railway system. This study investigates the friction and wear properties of high-speed railway brake discs under conditions of high humidity and varying braking speeds. The findings are crucial for ensuring the safe operation of high-speed trains in humid environments. A self-developed pin-disc/roller multi-function friction and wear testing machine was utilized to examine different ambient humidity levels (65%, 98% RH (Relative Humidity)) and constant braking speeds (600, 400, 200 rad/min), as well as alternating braking speeds (600-400, 600-200 rad/min). The primary contents and conclusions are as follows.

(1) When using constant braking speed, the friction coefficient and disc surface temperature of high-speed train braking materials under 98% RH are smaller than those under 65% RH; when the ambient humidity is the same, the friction coefficient, the wear rate, the disc surface temperature and the degree of wear of the braking materials are reduced with the decrease of the braking speed; considering the coupling of environmental humidity and braking speed, it is found that under high speed (600, 400 rad/min) and high humidity (98% RH), braking speed is the dominant influencing factor; while under high humidity (98% RH) and low speed (200 rad/min), environmental humidity is the dominant influencing factor. Under natural conditions, the wear mechanism of the braking material is mainly abrasive wear and adhesive wear; while under high humidity, the wear mechanism is mainly abrasive wear, adhesive wear and surface fatigue wear.

(2) When the braking speed is alternating, the average friction coefficient of the brake material and the average disc surface temperature are the largest at 600-400 rad/min, followed by 600-400-200 rad/min, and the smallest at 600-200 rad/min. The wear rate and surface damage degree of brake materials are the maximum under 600-400 rad/min, and the minimum under 600-400-200 rad/min. The friction coefficient and disc surface temperature of the brake material under the condition of 98% RH are less than 65% RH, and the wear rate and surface damage of the brake material under the condition of 600-400 rad/min are higher than 98% RH. However, at 600-200 and 600-400-200 rad/min, the wear rate and surface wear degree are greater at 98% RH. At 65% RH, the wear mechanism of brake materials is mainly abrasive wear and adhesive wear. At 98% RH, the main wear mechanisms are oxidation wear, adhesion wear and surface fatigue wear.

Through comprehensive comparison, it is found that the wear rate and surface damage degree of the brake materials are the highest under the conditions of 65%RH and 600rad/min. At 65%RH, 200rad/min, the wear rate is the lowest and the surface damage degree is the least.

References

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