

Analysis of corrosion causes of weathering resistant steel for railway freight car body

Du Wei*

Institute of Metals and Chemistry, China Academy of Railway Sciences Group Corporation, Beijing 100081, China;

Abstract: This paper mainly studies the corrosion problem of weathering steel materials used in railway freight car bodies. Using optical microscopy, scanning electron microscopy (SEM), energy spectrum and X-ray diffraction, among other techniques, the corrosion characteristics of weathering steel materials used in railway freight car bodies are analyzed. At the same time, ion chromatography technology is used to study the residual liquids and foam solutions within the car body. The results show that both the residual liquids and the foam solutions contain high concentrations of Cl^- and SO_4^{2-} , which are the main factors causing corrosion of the railway freight car body. Additionally, the door frame area of the car body is subject to prolonged moisture, which accelerates the electrochemical corrosion of the weathering steel material used in the door frame, resulting in more severe corrosion of the door frame compared to other parts of the car body.

Keywords: railway freight cars; corrosion; residual liquid; electrochemical corrosion

Railway freight is the main mode of transportation, and the safety and reliability of operation are particularly important. Due to the large difference in climatic conditions, especially in the southern region affected by the Marine climate (high temperature, high salt, high humidity), coupled with the harsh working conditions of trucks, the steel structure of the car body not only bears the impact of friction and corrosion of goods in the full temperature environment, but also bears the impact of bumping and unloading machinery, the protective coating inside the car body will be damaged in a short time. Resulting in rapid internal corrosion of the truck body.

Conclusion

(1) The corrosion of truck body materials is mainly electrochemical corrosion, and the corrosion of door materials is more obvious than that of other parts. The corrosion products are mainly Fe oxides and hydroxides, and finally generate stable $\gamma\text{-FeOOH}$. There are cracks on the surface of the corrosion products of the vehicle body, which

reduces the binding force and strength of the corrosion products and weakens the protective effect of the corrosion products on the matrix.

(2) The presence of Si and Ca in the rust layer is brought by atmospheric dust, and S and Cl are introduced by rain or dust suppressor. There are many cracks on the surface of the rust layer, and the corrosion products have weak protective effect on the matrix.

(3) The door foam sealant has tight pore arrangement, high water absorption, and relatively high concentration of corrosive ions inside the void. Cl^- and SO_4^{2-} will aggravate the electrochemical corrosion process of metal materials in the car body in a humid environment.

(4) The main reasons affecting the corrosion of car body materials: high-frequency impact of goods, corrosive ions in a humid environment.