

## Damage mechanism of bearing steel under the interaction of sodium chloride solution and rolling contact fatigue

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**Abstract** The main bearing of shield machine is one of the crucial parts of shield machine, which plays an important role in the field of tunneling[1]. It is important to study the failure mechanism of bearing for improving the fatigue life of bearing. The bearings are used to support large loads and enabling rotary motion with as little friction as possible[2]. However, the main bearing of shield machine will inevitably be affected by the underground corrosion environment due to failure of seal, especially the corrosion of groundwater. On the one hand, the lubrication performance of traditional bearing lubricating oil is reduced after being mixed with brine solution. And on the other hand, corrosion will induce surface damage and premature bearing failure. In this paper, the effects of sodium chloride solution mixed with two common lubricating oils on the failure mechanism of bearing rolling contact fatigue are compared. For 320 lubricating oil with higher viscosity, the bearing steel has a higher fatigue life under good lubrication conditions[3]. However, when the lubricant is mixed with sodium chloride solution[4], the surface of bearing steel suffers serious pit corrosion and the rolling contact fatigue life of bearing is greatly reduced, due to its good miscibility with aqueous solution. In 4050 lubricating oil with lower viscosity, the bearing steel has a

lower fatigue life. Because the low viscosity 4050 lubricating oil is not miscible with aqueous solution, the corrosion in 4050 lubricating oil is mainly shallow corrosion. Water insoluble lubricating oil can protect bearing steel from corrosion in sodium chloride solution. Therefore, it is suggested that the high viscosity and the insolubility of aqueous solution should be considered at the same time when selecting the lubricating oil for the main bearing of the shield machine to ensure the stability of the bearing in the corrosive environment.

**Keywords** *Rolling contact fatigue, Bearing steel, Corrosion, Lubricants, Failure*

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