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Carbide Types and Quantity: Impacts on surface finish and wear characteristics in graphitic shell materials for rolls in hot rolling applications

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Work rolls used in hot rolling of steel suffer severe wear caused by combinations of adhesion, abrasion, rolling contact fatigue, thermal fatigue, and tribo-chemical corrosive attack. Depending on the specific wear mechanisms, damage of these rolls may include loss of material, surface, and subsurface cracking, as well as impairment of the surface finish. In this work, wear tests were performed using a custom-designed roll test rig which simulates the contact conditions between the work roll, the back-up roll and the hot-rolled steel. To simulate typical conditions occurring in a hot rolling mill, different contact pressures and rolling temperatures were considered. Wear and damage mechanisms were analyzed by optical microscopy and scanning electron microscopy (SEM). A systematic approach was used for correlating wear and microstructure of the roll materials. Therefore, graphitic high-speed steels (G-HSS) with different fractions and types of carbides were investigated. MC and M2C/M6C were identified to influence mainly the wear behavior of graphitic containing shell materials. Increasing the fraction of these carbides reduced the wear rate but increased the surface roughness. The optimum balance between carbide types, graphite content and metal matrix has been identified as mandatory for achieving high wear performance of work roll materials.

Speaker Country

Österreich

Summary

Work rolls used in hot rolling of steel suffer severe wear caused by combinations of adhesion, abrasion, rolling contact fatigue, thermal fatigue, and tribo-chemical corrosive attack. Depending on the specific wear mechanisms, damage of these rolls may include loss of material, surface, and subsurface cracking, as well as impairment of the surface finish. In this work, wear tests were performed using a custom-designed roll test rig which simulates the contact conditions between the work roll, the back-up roll and the hot-rolled steel. To simulate typical conditions occurring in a hot rolling mill, different contact pressures and rolling temperatures were considered. Wear and damage mechanisms were analyzed by optical microscopy and scanning electron microscopy (SEM). A systematic approach was used for correlating wear and microstructure of the roll materials. Therefore, graphitic high-speed steels (G-HSS) with different fractions and types of carbides were investigated. MC and M2C/M6C were identified to influence mainly the wear behavior of graphitic containing shell materials. Increasing the fraction of these carbides reduced the wear rate but increased the surface roughness. The optimum balance between carbide types, graphite content and metal matrix has been identified as mandatory for achieving high wear performance of work roll materials.

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