

عنوان مقاله:

Failure Mechanisms and Solutions for Fin-Pass Rolls Repair-Ring at an Electric Resistance Welding Pipe Plant

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خلاصه مقاله:

Fin-pass rolls are the latest series of rolls in electric resistance welding (ERW) pipe production lines that form the sheets to tubular shape and adjust the edges of the sheet for welding. The rolls (made of AISI ۸۶۲۲ steel) lose their proper function after about ۱۰ years of operation due to severe wear and change of their original surface profile. The worn portions were removed by grinding and replaced by an AISI D۲ high carbon steel ring to repair these rolls. After a short time of service (about one year), the edge of the repair ring was exposed to severe spalling and fracture. The present study investigated the causes of the rapid failure of the AISI D۲ repair ring and proposed a solution to the problem. The surface morphology, hardness, and wear resistance were studied. Moreover, the stress analysis of fin-pass rolls was studied using ABAQUS ۶.۱۴ finite element software for the closer investigation of the failure mechanism. The leading cause of spalling was the inherent brittleness of the AISI D۲ steel and the presence of a high-stress concentration at the edges of the repair ring. To overcome this problem, carburized AISI P۲۰ steel, case hardened AISI ۴۱۴۰ steel, and hard chromium electroplated AISI ۴۱۴۰ steel were replaced, and the resulting properties were studied. The highest resistance to spalling and wear occurred with carburized AISI P۲۰ steel because of the high surface hardness and the gradual increase of toughness from the surface to the depth in the carburizing process, increasing the wear resistance and retarding the growth of fatigue cracks.

کلمات کلیدی:

Carburizing, Failure mechanism, Finite element simulation, fin-pass roller, Wear test

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