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Microstructure and Mechanical Properties of Weld Metal of Railway Wheel Steel

Yongjoon Kang, Seo-Wan Kim, Kangmyung Seo, Dongjin Oh, Sangwoo Song

¹Korea Institute of Materials Science, Changwon-si, South Korea

During operation of railway vehicle, the severe wear occurs in the contact region between wheel flange and rail gauge corner; since the rail is harder than the wheel, the wear is concentrated on the wheel flange. The decrease in thickness of wheel flange increases the probability of train derailment accidents. Thus, the flange thickness is maintained above a critical level by regular wheel re-profiling by machining. However, only a limited number of the re-profiling processes is possible during the wheel life, because a significant amount of wheel machining is required to restore the flange thickness. In this work, a weld overlay repair technique was developed to make the wheel life longer and minimize the frequency of wheel replacement. The effect of welding process variables on the mechanical properties and microstructure of the overlaid weld metal was investigated. The tensile strength and impact toughness of the weld metal met the requirements of ER7 grade specified in EN 13262; the impact toughness was much higher than that of the base metal of wheel steel. The microstructure observation showed that the weld metal consisted mainly of acicular ferrite, while that of the base metal was composed of pearlite and ferrite.