World Academy of Science, Engineering and Technology
International Journal of Mechanical and Industrial Engineering
Vol:10, No:12, 2016

Effect of Weld Build-up on the Mechanical Performance of Railway Wheels

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Abstract : Repairing railway wheels by weld build-up is one of the technological solutions that have been applied in the past. However, the effects of this process on the material properties are not well established. The effects of the weld build-up on the mechanical properties of the wheel material in comparison to the required mechanical properties for proper service performance were investigated in this study. A turning process was used to remove the worn surface from the railway wheel. During this process 5mm thickness was removed to ensure that, if there was any weld build-up done in the previous years, it was removed. This was followed by welding a round bar on the sides of the wheel to provide build-up guide. There were two welding processes performed, namely submerged arc welding (SAW) and gas metal arc welding (GMAW). Submerged arc welding (SAW) was used to build up weld on one rim while the other rim was just left with metal arc welding of the round bar at the edges. Both processes produced hardness values that were lower than that of the parent material of 195 HV as the GMAW welds had an average of 184 HV and SAW had an average of 194 HV. Whilst a number of defects were noted on the GMAW welds at both macro and micro levels, SAW welds had less defects and they were all micro defects. All the microstructures were ferritic but with differences in grain sizes. Furthermore, in the SAW weld build up, the grains of the weld build-up appeared to be elongated which was a result of the cooling rate. Using GMAW instead of SAW would result in improved wear and fatigue performance.

Keywords : submerged arc welding, gas metal arc welding, railway wheel, microstructure, micro hardness
Conference Title : ICME 2016 : International Conference on Mechanical Engineering
Conference Location : Rome, Italy
Conference Dates : December 08-09, 2016