EFFECT OF HEAT INPUT RATIO TEMPER BEAD WELDING ON THE CORROSION RATE MICROSTRUCTURE AND MECHANICAL PROPERTIES OF THE MATERIAL SA 516 GRADE 70

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ABSTRACT

Temper bead welding technique has been cultivated specifically for the repair welding process. If temper bead welding techniques is performed, post weld heat treatment (PWHT) is not required to be done, because in the process of temper bead welding, each bead and layer obtain tempering effect on the bead and the previous layer. This can result in mechanical properties approaching weld which followed by a post weld heat treatment. This technique is very effective applied to welding repair on the components that have been installed, which it is not possible to be performed post weld heat treatment in furnace.

Temper bead welding performed on the SA 516 Grade 70 material with SMAW process using E7018 electrode with diameter 2.6 mm. Temper bead welding process is done by varying the ratio of inter-layer heat input of 1.2, 1.3 and 1.4 with commonly welding process as a comparison. After welding process, performed mechanical test on weld joint, mechanical properties test including hardness, impact toughness, bending test and microstructure observation in the weld metal and HAZ regions.

From the results microstructure observation in HAZ, the heat input ratio of 1.2 is composed of 29.63% pearlite phase, the heat input ratio of 1.3 is composed of perlite 37.98%, and heat input ratio of 1.4 is composed of 41.12% perlite, whereas non-temper bead welding + post weld heat treatment is composed of 33.88% perlite. The average hardness value in a row is 160 HV, 165 HV, 167 HV and 154 HV for non temper bead welding + post weld heat treatment. Charpy impact strength testing at various temperatures showed, increasing heat input ratio will decrease charpy impact strength, successively is 1.62 joules/mm², 1.47 joules/mm², 1.42 joules/mm² and 1.78 joules/mm² for non temper bead welding + post weld heat treatment. The corrosion test results showed, increasing of heat input ratio tends to be more rapidly corroded, the corrosion rate of the heat input ratio of 1.2, 1.3 and 1.4 successively is 1519.85 mpy, 1777.02 mpy and 1726.59 mpy, the lowest corrosion rate obtained in non temper bead welding + post weld heat treatment at 1246.58 mpy. Overall temper bead welding with low heat input ratio is 1.2 can produce good mechanical properties, approaching the welding ordinary + post weld heat treatment.

Keywords: temper bead, SA 516 grade 70, heat input ratio.
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