

Microstructure and Hardness Changes on T91 Weld Joint after Heating at 560°C

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Abstract : T91 steel has been used as construction material for superheater tubes in sub-critical and super critical boiler. This steel was developed with higher creep strength property as compared to conventional low alloy steel. However, this steel is also susceptible to materials degradation due to its sensitivity to heat treatment especially Post Weld Heat Treatment (PWHT) after weld repair process. Review of PWHT process shows that the holding temperature may different from one batch to other batch of samples depending on the material composition. This issue was reviewed by many researchers and one of the potential solutions is the development of weld repair process without PWHT. This process is possible with the use of temper bead welding technique. However, study has shown the hardness value across the weld joint with exception of PWHT is much higher compare to recommended hardness value. Based on the above findings, a study to evaluate the microstructure and hardness changes of T91 weld joint after heating at 560°C at varying duration was carried out. This study was carried out to evaluate the possibility of self-tempering process during in-service period. In this study, the T91 weld joint was heat-up in air furnace at 560°C for duration of 50 and 150 hours. The heating process was controlled with heating rate of 200°C/hours, and cooling rate about 100°C/hours. Following this process, samples were prepared for the microstructure examination and hardness evaluation. Results have shown full tempered martensite structure and acceptance hardness value was achieved after 50 hours heating. This result shows that the thin component such as T91 superheater tubes is able to self-tempering during service hour.

Keywords : T91, weld-joint, tempered martensite, self-tempering

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