

High-Temperature Behavior of Boiler Steel by Friction Stir Processing

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Abstract : High temperature corrosion is an imperative material degradation method experienced in thermal power plants and other energy generation sectors. Metallic materials such as ferritic steels have special properties such as easy fabrication and machinability, low cost, but a serious drawback of these materials is the worsening in properties initiating from the interaction with the environments. The metallic materials do not endure higher temperatures for extensive period of time because of their poor corrosion resistance. Friction Stir Processing (FSP), has emerged as the potent surface modification means and control of microstructure in thermo mechanically heat affecting zones of various metal alloys. In the current research work, FSP was done on the boiler tube of SA 210 Grade A1 material which is regularly used by thermal power plants. The strengthening of SA210 Grade A1 boiler steel through microstructural refinement by Friction Stir Processing (FSP) and analyze the effect of the same on high temperature corrosion behavior. The high temperature corrosion performance of the unprocessed and the FSPed specimens were evaluated in the laboratory using molten salt environment of $\text{Na}_2\text{SO}_4\text{-}82\%\text{Fe}_2(\text{SO}_4)$. The unprocessed and FSPed low carbon steel Gr A1 evaluation was done in terms of microstructure, corrosion resistance, mechanical properties like hardness- tensile. The in-depth characterization was done by EBSD, SEM/EDS and X-ray mapping analyses with an aim to propose the mechanism behind high temperature corrosion behavior of the FSPed steel.

Keywords : boiler steel, characterization, corrosion, EBSD/SEM/EDS/XRD, friction stir processing

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