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A Case Study on the Failure Mechanism of Superheater Tube

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Abstract : *Many superheater boiler tubes have premature failures which are caused by mechanical failures such as thermal fatigue, overheating, stress rupture and corrosion failure. These are the major causes of materials failure in superheater tubes in power plants using oil as fuel. The parameters causing the failure of the tubes are boiler operation, superheater deposit composition and material selection. Fractographic studies of fracture surface features, metallographic studies of microstructure and chemical composition analysis are presented as the failure analysis in determining the failure mode of superheater tube. Mechanical properties and metallographic examination using optical microscope, scanning electron microscope (SEM) and energy dispersive X-ray analysis (EDX) have indicated that the failure was caused by a combination of thermal fatigue, stress corrosion cracking and stress rupture fracture.*

Introduction : Failure statistics by Riley Stoker Department for the past 20 years has shown that failure by location on superheaters is as much as 44.8%, failure caused by mechanical factors is 81% and 19% is due to corrosion (David, 1983). Based on another survey compiled by a laboratory over a period of 12 years, it was found that failure due to overheating was 48.7%, 21.5% caused by fatigue, 16.5% due to corrosion and the remaining 13.3% caused by improper materials selection (ASM Metals Handbook, 1975).

This paper describes the failure mechanisms of superheater tube. A variety of micromechanisms of fracture have been observed in failed superheater tube, such as crazing cracks, grain boundary voids, intergranular cracks, multi-branch crack tips, corrosion products and secondary cracks. Studies of the fracture surface and microstructure features