

ABSTRACT

Thermomechanical treatments that alloys experience during fabrication and in high temperature service, or those given to improve their mechanical properties, bring about alterations in their microstructures. These alterations may include trapping of beneficial elements (e.g., Cr) as secondary precipitates or change in grain size, that can influence the oxidation resistance of the alloys. 'Chrome-Moly' steels are quite susceptible to such alterations in microstructure. Present investigations have been carried out to understand the influence of a few common variations in alloy microstructure on high temperature oxidation of commercial varieties of 2.25Cr-1Mo and 9Cr-1Mo steels. Microstructural variations chosen for the present studies are : (a) those involving precipitation of Cr-rich secondary phases, on thermal treatments (tempering/ageing), (b) variation in the grain size of the alloy, and (c) those caused due to welding of the steels.

The investigations include understanding the microstructural variations effected due to different heat treatments experienced by the two steels, oxidation behaviour of the heat treated alloys, post-oxidation characterization of the oxide scales by SEM/EDX, SIMS and XRD, and characterization of cracking/spallation of the scales by acoustic emission monitoring, during oxidation.

Thermal treatments causing considerable trapping of Cr have been found to be detrimental for oxidation of 2.25Cr-1Mo as well as 9Cr-1Mo steel. Similarly, a decrease in grain size is detrimental for both the steels : due to increase in internal oxidation along grain boundaries in 2.25Cr-1Mo steel, and due to increase in propensity for spallation in 9Cr-1Mo steel.

In the case of the oxidation of the weldments of 2Cr-1Mo steel, there is a combined influence of grain size and secondary precipitation in the heat affected zone of the weldment, that oxidizes at much higher rates.

KEY WORDS : GRAIN SIZE, NORMALIZING, QUENCHING, ANNEALING, TEMPERING, FERRITE, BAINITE, AUSTENITE, PEARLITE, MARTENSITE, SECONDARY PRECIPITATES, SPALLATION, WELDMENT, WELD METAL, HEAT AFFECTED ZONE (HAZ), ACOUSTIC EMISSION, SECONDARY ION MASS SPECTROMETRY.