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Effects on steel oxidation kinetics and oxide scale features of hydrogen combustion

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The hydrogen combustion in reheating and heat treatment furnaces produces a new furnace atmosphere without or with lower concentration of CO2 and consequently higher H2O concentration. The higher water vapour content can change steel's oxidation kinetic, as well as the oxide scale morphology and the oxide-steel interface features thus affecting the scale adhesion. The oxidation kinetics and scale features of different steel grades were studied by TGA (Thermo Gravimetric Analysis) at 1200°C, 1050°C and 900°C in atmospheres simulating working conditions of the burner with 100% NG combustion or 100%H2 combustion, followed by scale characterization by SEM with EDS analysis. Tests are carried out on large variety of steel grades (carbon steels and stainless steels) to evaluate also the effect of steel chemistry. Results show increase in oxide scale growth especially for the higher temperature range; differences among the steel grades according to the presence of some alloying elements have been also outlined. In some cases, the interface between scale and steel appears influenced by the higher presence of H2O in the furnace atmosphere.

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