High temperature corrosion investigation in an oxyfuel combustion test rig

Oxyfuel firing and subsequent capture of CO2 is a way to reduce CO2 emissions from coal-fired boilers. Literature is summarized highlighting results which may contribute to understanding of the corrosion processes in an oxyfuel boiler. Tests were conducted in a 500 kWth oxyfuel test facility constructed by Brandenburg Technical University to gain understanding into oxyfuel firing. Two air-cooled corrosion probes were exposed in this oxyfuel combustion chamber where the fuel was lignite. Gas composition was measured at the location of testing. Various alloys from a 2½ Cr steel, austenitic steels to nickel alloys were exposed at set metal temperatures of 570 and 630 °C for 287 h. The specimens were investigated using light optical and scanning electron microscopy and X-ray diffraction. The deposit on the probe contained predominantly CaSO4 and Fe2O3. Oxide thickness and depth of the precipitated (perhaps carburized) zone was used as a measure of corrosion rates. The lowest alloyed steel had the highest corrosion rate, and the other austenitic and nickel alloys had much lower corrosion rates. Precipitates in the alloy adjacent the corrosion front were revealed for both Sanicro 28 and C-276. However, it was observed that precipitates were present on both the concave and fireside convex tube surfaces, thus oxyfuel conditions cannot be responsible for these precipitations.