

Hot Corrosion Susceptibility of Uncoated Boiler Tubes during High Vanadium Containing Fuel Oil Operation in Boiler Applications

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Abstract : Boiler-fired power plants that operate steam turbines in Saudi Arabia use vanadium-containing fuel oil. In a super- or sub-critical steam cycle, the skin temperature of boiler tube metal can reach close to 600-1000°C depending on the location of the tubes. At high temperatures, corrosion by the sodium-vanadium-oxygen-sulfur eutectic can become a significant risk. The experimental work utilized a state-of-the-art high-temperature, high-pressure burner rig at KAUST, King Abdullah University of Science and Technology. To establish corrosion rates of different boiler tubes and materials, SA 213 T12, SA 213 T22, SA 213 T91, and Inconel 600, were used under various corrosive media, including vanadium to sulfur levels and vanadium to sodium ratios. The results obtained from the experiments establish a corrosion rate map for the materials involved and layout an empirical framework to rank the life of boiler tube materials under different operating conditions. Safe windows of operation are proposed for burning liquid fuels under varying vanadium, sodium, and sulfur levels before corrosion rates become a matter of significance under high-temperature conditions

Keywords : boiler tube life, hot corrosion, steam boilers, vanadium in fuel oil

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