Effect of Air Pre-Oxidation to CS\* and SS\*\* on their High Temperature Air Oxidation Behavior

***Abstract*** — **In this paper, air pre-oxidation technique was developed in order to improve the oxidation resistance of carbon steel (0.131 wt%) and stainless steel (304L). The oxidation behavior of carbon steel and stainless steel specimens with and without pre-oxidation was studied over the temperature range 450 to 550°C for up to 120h. The discontinuous oxidation behavior of the selected experimental materials was investigated in static air. The employment of pre-oxidation at 450°C for 5 hours to carbon steel and at 500°C for 5 hours to stainless steel showed tremendous improvements to the oxidation kinetics for both carbon steel and stainless steel, especially at relatively low temperatures – 450°C and 500°C. Kinetic data of carbon steel showed rapid increase of weight compared with stainless steel throughout the selected temperature range. The formation of Cr2O3 layer improved the oxidation resistance of stainless steel. Cr2O3 layer acts as a diffusion barrier to the reactive species. Also, the oxidation process of carbon steel was found to be controlled by the formation of relatively thin and adherent layer of Fe2O3, especially at low exposure temperature (e.g. 450°C). Whereas, at higher temperatures (e.g. 550°C), the Fe2O3 layer failed to protect carbon steel from further oxidation even for short exposure time. The scale formed on carbon steel at 550°C severely cracked and spalled off especially at places of sample corners. Results of this research revealed that, alloying elements in stainless steel were more beneficial to oxidation resistance than pre-oxidation to steel, throughout the whole range of time and temperature of this study.**

\* carbon steel (0.131 wt%).

\*\* stainless steel (304L).