

Effect of Sulfur on the High-Temperature Oxidation of DIN1.4091

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Abstract : Centrifugal casting is a metal casting method that uses forces made by centripetal acceleration to distribute molten material in mold. Centrifugal cast parts manufactured in industry contain gas pipes and water supply lines, moreover rings, turbocharger, bushings, brake drums. Turbochargers were exposed to exhaust temperatures of 900-1050°C require a material for the corrosion resistance that will withstand such high component temperatures during the entire service life of the vehicle. Hence, the study of corrosion resistance for turbocharger is important for practical application. DIN1.4091 steels were used widely. The DIN1.4091 steels whose compositions were Fe-34.4Cr-14.5Ni-2.5Mo-0.4W-0.4Mn-0.5Si-(0.009 or 0.35)S (wt.%) were centrifugally cast, and oxidized at 900°C for 50-200 h in order to find the effect of sulfur on the high-temperature oxidation of Fe-34.4Cr-14.5Ni-2.5Mo-0.4W-0.4Mn-0.5Si-(0.009 or 0.35)S (wt.%) alloys. These alloys formed oxide scales that consisted primarily of Cr₂O₃ as the major oxide and Cr₂MnO₄ as the minor one through preferential oxidation of Cr and Mn. Cr formed a thin CrOx oxide film on the surface to prevent further oxidation, and when it is added more than 20%, the sulphide decreased corrosion rate. The high affinity of Mn with S, led to the formation of scattered MnS inclusions, particularly in the 0.35S-containing cast alloy. Sulfur was harmful to the oxidation resistance because it deteriorated the scale/alloy adherence so as to accelerate the adherence and compactness of the formed scales. Acknowledgement: This research was supported by Basic Science Research Program through the National Research Foundation of Korea (NRF) funded by the Ministry of Education (2016R1A2B1013169).

Keywords : centrifugal casting, turbocharger, sulfur, oxidation, Fe-34.4Cr-14.5Ni alloy

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