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High-temperature Corrosion of Chromium(III) Electroplating in N₂/0.1%H₂S Gas

The electroplated chromium coatings are emerging as the important candidate material of choice for machinery and automobile applications owing to its decorative colour, high hardness, good resistance to wear and corrosion. They are usually synthesized in the hexavalent chromium (Cr+6) bath. However, the hexavalent chromium plating solution suffers from serious health and environmental problems. To alternate the hexavalent chromium plating, the trivalent chromium plating is being developed. It is relatively non-toxic. In this study, chromium(III) coating was electroplated onto a steel substrate, and corroded at high temperatures in N₂/H₂S-mixed gas in order to study its the corrosion behavior in the serious H₂S-containing atmosphere. The electroplated chromium(III) coating was corroded at 500-900 °C in N₂/0.1%H₂S-mixed gas. Relatively thin Cr₂O₃ oxide layers formed on the coating, accompanied with the evolution of CO or CO₂ gases. The oxidation occurred mainly along the pre-existing cracks in the Cr-C coating. The effect of heating on the microstructure of the Cr-C coating during corrosion tests was also studied.

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