The Corrosion Behavior of Cr-based Deposited Steel Prepared from Cr+3-based Plating Baths

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Cr is widely used as a coating material for precision mechanical parts, owing to having suitable mechanical properties and superior corrosion resistance. Generally, a bright Cr deposit on a metal component could be obtained through electroplating in a Cr^{6+}-based plating bath. However, Cr^{6+} ions are highly toxic in nature. According to RoHS, the use of Cr^{6+}- ions for electroplating is banned for production of electronic devices since July 2007. Many researchers have attempted to developed alternative electroplating baths to replace the Cr^{6+}-based bath. In them, Cr^{3+}-based plating bath is a potential alternative, because a Cr deposit could be achieved from the Cr^{3+}-based bath. In our study, a suitable Cr^{3+}-based plating bath was developed with which a high current efficiency more than 50% and an electroplating current density between 30 to 60 A/dm^2 were recognized. A Cr-C deposit with a thickness of 50 μm can be prepared within 1500 s. Moreover, the hardness of Cr-C deposit could be increased to 1600 Hv after heating with highly energy-concentrated heating methods, such as flame heating and high frequency induction heating, for 1 s. That is, the anneal-hardened Cr-C deposited specimen has superior wear and corrosion resistance. Based on the Cr^{3+}-based plating bath, Cr-Ni-C. Cr-Fe-C, and Cr-Ni-Fe-C alloy deposits were developed. However, some through-deposit cracks were found in the Cr-C deposit, resulting in obvious decrease in its corrosion protection. To increase the corrosion resistance of Cr-C deposited specimen, we proposed two methods. The first one is using a soft Ni or Cu undercoat before Cr-C electroplating. Another method is using two-step electroplating in which a Ni-C deposit without cracks was prepared and followed by Cr-Ni-C electroplating. The above-mentioned results will be presented in the meeting.