

Analysis of Thermal Change in the Composition of No-rinse Version of Chromium Phosphate Coatings

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Abstract

The change in the composition of chromium phosphate at drying temperature up to 400°C has been investigated using DTA, GC-MASS and XPS. According to the DTA on the deposits from a solution containing Cr⁶⁺, Cr³⁺ and PO₄³⁻ species, two distinct peaks due to endothermic (85~200°C) and exothermic (200~400°C) reactions were obtained. MASS analysis indicated the presence of high molecular weight fragments at the final endothermic stage (~200°C), suggesting that a polymerization occurred. The polymerized films, however, partially decomposed at the subsequent exothermic stage (around 300°C). XPS analysis has disclosed that the deposits consist of CrO₃, Cr₂O₃, Cr(OH)₃ · nH₂O and CrPO₄ species and that the composition did not change appreciably at the endothermic stage but slightly increased in CrPO₄ at the exothermic stage. However, in the water insoluble components of the deposits, Cr(III) species (major part) decreased and the Cr(VI) (minor part) increased by endothermic reaction, and the Cr(VI) decreased by the following exothermic reaction, suggesting that de-oxygenation reaction has occurred.

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