

# The Development of Thinner Chromium-Free Chemical for Zinc Plating

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## Abstract

The first-generation chromium-free chemical consists of a solution of resins with a phosphoric acid additive. It forms a thicker coating layer providing good corrosion resistance on a par with chromium treatment. However, there are several problems associated with its performance. This study details an attempt to develop the next-generation chromium-free chemical. The silane compound is the major factor influencing the properties of the new coating film. It improves the performances of all different kinds of properties. A result of our investigations, it is important to mention with respect to the first-generation chromium-free chemical that the concentration of phosphorous has an adverse affect on some properties. However the next-generation chromium-free chemical does not require the phosphoric acid additive. The silane compound, which improves the interface bonding, is used as an alternative to the phosphoric acid additive. Furthermore the new coating film has excellent barrier efficiency of a polymer layer generated by the condensation of silane, even though the coating film is thinner. We have achieved the development of a thinner chromium-free chemical for zinc plating.

**Keywords:** chromium-free, corrosion resistance, chromium treatment, zinc plating, silane compound,

## 1. Introduction

The chromium treatment had been commonly applied to zinc plating in order to provide paint adhesion and corrosion resistance<sup>1-3)</sup>. However the

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hexavalent chromium component was known to be harmful to the human body. There were moves to restrict the use by the legislation of such regulations as RoHS and ELV<sup>4),5)</sup>. The first generation chromium-free treatment was introduced into this field in 2001. In the last several years, it has been applied as an alternative to the chromium treatment<sup>6),7)</sup>. It shows good corrosion resistance on a par with the chromium treatment. However, there are several problems associated with performances, such as layer resistivity, blackening resistance in a humid environment and cost<sup>8),9)</sup>. Why is it difficult to achieve good performances