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The Property of Colored Chemical Conversion on Various Metals with Iso-solution

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Abstract

So as to solve the chemical conversion challenge of various metals in a cell at the same time, a process technology with complex formula of fluoroziconate/ fluotitanate and some addictives used on aluminum alloy/steel and other metallic materials was studied. Investigated influence of the zirconium fluoride acid salt, film forming additive, technological parameters such as pH, temperature, time on conversion coating color, golden yellow and blue color coating were produced on aluminum alloy and steel respectively. Tafel polarization curve showed that the bare aluminum alloy corrosion resistance improved significantly. By virtue of Energy Dispersive Spectrometer (EDS), its' results show that Al/Ti/Mo/O/F and a small quantity of C are the main composed elements of the film. And X-ray Photoelectronic Spectroscopy (XPS) demonstrated that the combined compound of each elements are $Mo_2O_5/MoO_3/TiO_2/MgF_2$.

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1. Introduction

In order to decrease fuel consumption and environmental pollution, automobile industry is keeping big step to the direction of "weight losing". Lighten a car body's weight is one of the major measurements to enhance economical efficience of cars and allocate fuel and environment pressure [1, 2]. In most case, with a 10% weight loss on a car, 6-8% oil saved and a 1% weight reduction on moving parts, 2% saved. It is a obvious direction to use

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light but high strength material to replace conventional steel parts. So a series of light metals using technologies such as ASF aluminum Space Frame, aluminium motor, hub are popping up and becoming more and more universality. Usually steel and galvanized steel are the main materials and aluminum alloy is rarely used as cars' body material. The conventional pre-treatment of automotive-planting technology is phosphating, but when it used on aluminum and its alloy, dissolved Al^{3+} can poision the whole solution quickly and the ability of film formation reduced badly [3]. So the conventional phosphating technology is not suitable for used on aluminum alloy any more. Besides, taking the structure strength of a car into account, it is necessary to inlay or rivet steel and other nonferrous metals on aluminum matrix. So with the specialty of these features, the coating pre-treatment of a car need to reconsider and meet the requirement of two or more different metals processed in a cell at the same time [4-7]. For the sake of accommodating the trend of surface treatment in the automobile industry, a relevant process technology named multi-metal colored chemical conversion was developed. It is a combination of fluoroziconate/ fluotitanate main salt and some addictives [8-10]. This convention allows operator according film color to judge if the film is on or not. The adhesion level between film and organic coating is up to phosphating technology.

Nomenclature

g	gram
L	liter
eV	electron-volt
mV	millivolt
s	second
nm	nanometer
mm	millimeter
min	minute

2. Experimental

2.1. Materials and Treatment Pattern

2002/6016 aluminium alloy and deep punching steel, of which a single metal dipping, multi-material dipping, multi-material riveting dipping were employed. Various Metals extruded panels were cut into 70mm×30mm×5mm for experimentals. After degreasing by soaking in specific treating agent provided by Wuhan Research Institute of Material Protection and two times runny washing, the sample was immersed in Ti/Zr/Mo conversion bath (pH 3.5-3.8) for 5-7min in room temperature [11-13]. The conversion bath contain 2g/L K_2TiF_6,0.8g/L K_2ZrF_6,0.4g/L molybdate salt, 0.6g/L polyhydroxy organic acid. It is required using deionized water for the second washing.

2.2. Testing of Chemical Conversion Film

The anti-corrosion performance of the coating was studied by Tafel curve using Parstat2733 electrochemical workstation with three classical electrode. For a comparison, the untreated and a classical Cr^{6+} conversion bath (commercial product) treated samples (CCC-treated) were also tested. The samples with 1.5cm2 area unmasked, Film property tests carbon rod and saturated calomel electrode (SCE) were as working electrode, counter electrode and the reference electrode respectively. The setting parameters were set to be 0.667mv/s scanning rate. The test started after 30min soaking into 5% NaCl test bath to obtain a steady open circuit potential [14].

Samples covered Ti/Zr/Mo colored coating was characterized by VG-Mutilab2000X-ray photoelectron spectroscopy (XPS) with aluminum KaX-rays at 300W. The C1s peak (binding energy of 285.0eV) was used as internal reference for all spectra. Microphotographs of samples were obtained using Philips JSM-6510 scanning electron microscope. The SEM is equipped with an EDAX CDU Leap detector for energy dispersive X-ray analysis (EDXA).

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