# Optimal condition of electrolytic coloring on A390 Aluminum vehicle casting


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**ABSTRACT**

Aluminum alloys are widely used in vehicle castings, but the alloys are easily oxidized in the air and lose their performance. Anodizing treatment is utilized to solve this problem in industry. Aluminum alloy with high Si content usually hasn ’ t luxurious colors for conventional anodizing treated oxide film. Therefore, it is worthy to study the method of producing special luxurious colors of appearance on the aluminum alloy with high Si content by electrolytic coloring anodizing treatment. The anodized oxide film will retain high hardness and increase added value through the optimal electrolytic coloring anodizing treatment found in this study. A390 aluminum alloy which has high Si content was used to cast the stepped type casting and vehicle piston casting in this study. The electrolytic coloring anodizing treatment used H2SO4, CuSO4 and Fe2(SO4) as the solution to anodize the castings. The parameters studied in this experiment include casting thickness, current density and electrolytic coloring anodizing time. The effect of these parameters on the oxide film will be evaluated to establish the optimal conditions of electrolytic coloring anodizing treatment for A390 aluminum alloy castings. The results of this study show that the thick section of A390 aluminum stepped type casting had the largest thickness of electrolytic coloring oxide film compared to those films formed on the thin and medium sections in stepped type casting. The reasons are related to the grain size of primary aluminum. In addition, the growth rate of oxide film formed on A390 aluminum casting by electrolytic coloring anodizing film will be inhibited when the film grew to contact with primary Si particles beneath the substrate. Finally, the scalloped substrate will be formed due to the envelopment of primary Si particles in the oxide film. The thickness of electrolytic coloring anodizing film of A390 aluminum stepped type casting increases with the increase of electrolytic coloring time, but it ’ s hardness decreases with the time. The reason may be related to the gel layer deposited at the bottom of porous layer of oxide film. The condition to achieve maximum thickness of the oxide film is 3.9 A/dm2 current density and 65 minutes electrolytic coloring time, while the condition to achieve maximum hardness of oxide film is 1.3 A/dm2 current density and 15 minutes electrolytic coloring time. The optimal condition for the thick section of A390 aluminum stepped type casting to produce bright yellowish color of electrolytic coloring anodizing film by using H2SO4, CuSO4 and Fe2(SO4) mixed-acid solution is 2.6 A/dm2 current density and 27.5 minutes electrolytic coloring time, but for the thin and medium sections, the optimal condition to obtain the same color is 2.6 A/dm2 current density and 15 minutes electrolytic coloring time. Using the optimal conditions mentioned above to electrolytic coloring the A390 aluminum alloy pistons, it is found that the color of oxide film of small piston is dark reddish yellow, while the color of oxide film of large piston is dark blue-gray. It ’ s worthy to say that the colors of oxide films of pistons are different from those colors of oxide films on the stepped type castings. The causes of this difference are related to the grains at the chill zone of superficial layer on the pistons and whether the surface of pistons are machined.



Keywords : A390 aluminum alloy、anodizing treatment、electrolytic coloring、CuSO4、Fe2(SO4)、piston


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