Study on hard anodizing A390 aluminum alloy by sulfuric acid

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ABSTRACT

Aluminum alloy, especially the Al-Si alloy, is widely used to replace the steel material to fabricate the components of vehicles because its excellent properties such as lightweight, good electrical and thermal conductivity, better corrosion resistance, good ductility and low cost etc., However the Al-Si alloy, due to the fact that it is easily oxidized and worn in the harsh and heavy-loaded environments, the extent of application was limited. The hard anodizing surface treatment is usually to improve this problem since the oxide films formed on the surface of casting parts via this process is wear-resistant and corrosion-resistant. The aims of this study are focused to explore the effects of process parameters including the electrical potential (voltage), the anodizing time and the thickness of castings on the sulfuric acid hard anodic oxide film of surface of A390 aluminum alloy castings with high silicon contents. The experiment of hard anodizing treatment was conducted under the low temperature environment with 0 to 3°C. The microhardness, the thickness of oxide film, the surface color of the step type-castings and piston castings were measured and the analyses of optical microscopy (OM) and scanning electron microscopy (SEM+EDS) on the hard anodic oxide film were observed to find the better process conditions of hard anodizing treatment for high silicon content aluminum alloy castings. The results of this study show that the microhardness of hard anodic oxide film was first increased and then decreased, while the thickness of films was gradually increased with the anodizing time increased. The time interval to acquire best microhardness of film is 120 minutes. The thickness of films was also increased, but the microhardness of hard anodic oxide film was first increased and then decreased with the electrical potential increased. The electrical potential to acquire best microhardness of film is 30 voltages. The microhardness of hard anodic oxide film was first increased and then decreased, while the thickness of films was gradually increased with the casting thickness increased. The casting thickness to acquire best microhardness of film is 25 mm. The CIE L*a*b* values were very different and the lightness and hue on the color of hard anodic oxide film were varied for specimen of different thickness step-type castings and piston castings under different conditions. The size and distribution of primary silicon and aluminum grain beneath the substrate of A390 aluminum alloy castings step-type castings and piston castings and the integrity of sulfuric acid hard anodic oxide film along surface of castings are the main causes to affect the microhardness, the thickness and the color appearance of Al-Si alloy castings.

Keywords : A390 aluminum alloy、hard anodizing、sulfuric acid、oxide film、piston casting

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