Study on sulfuric acid anodizing treatment of cast A390 aluminum alloy

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ABSTRACT

Owing to possessing good properties, aluminum alloy was often used in mechanical and lightweight vehicles industries. The natural oxide surface formed on aluminum has the abilities to resist corrosion and wear, but with increasing time and environmental danger, the natural oxide surface will be peeled and lose its resistance. Anodizing treatment on the aluminum alloy surface to form a stable anodic oxide film is the usual resolving method and can extend the application of aluminum alloy. Since there are very few data about anodizing treated aluminum alloy with high-silicon contents, especially for using sulfuric acid anodizing treatment, the purpose of this study is focused on investigating the effects of process parameters of sulfuric acid anodizing treatment including different thickness casting, current density, anodizing time and concentration of sulfuric acid on the A390 aluminum alloy stepped castings and piston castings with about 17 wt.% silicon content and establish the optimal skill. The results show that three thicknesses parts of the step-type casting have various grain sizes due to their different cooling rates. This resulted in the thick part of step-type casting had thicker oxide film then those of meddle or thin parts after sulfuric acid anodizing treatment. In the sulfuric acid anodizing process, the silicon phases were very slowly oxidized so that the anodic oxide film would form into a that wrapped the silicon grain. The thickness and hardness of anodic oxide film on the A390 aluminum alloy step-type castings was progressively increased with the anodizing time, and the larger hardness was due to the thicker film wrapping more silicon grains. Three thicknesses parts of the step-type casting had maximum values in the thickness and hardness of oxide film for the condition of 3 A/dm2 current density with 20 minutes anodizing time, but if the current density was increased to 4 A/dm2, the thickness and hardness of oxide film were decreased because the dissolution rate was larger then the formation rate for oxide film. -vi- The sulfuric acid anodic oxide film of A390 aluminum alloy would reveal canary yellow. The analysis of colorimeter showed that b* values were increased with the thickness of anodic film at 2 A/dm2 current The sulfuric acid anodic oxide film of A390 aluminum alloy would reveal canary yellow. The analysis of colorimeter showed that b* values were increased with the thickness of anodic film at 2 A/dm2 current density, but it was lowered for 3 A/dm2 current density, although the thickness of oxide film for 3 A/dm2 was larger then that for 2 A/dm2. The brightness and L* value reached to maximum value under sulfuric acid concentration of 14 wt.% with anodizing time of 20 minutes, but for sulfuric acid concentration of 17 wt.%, the optimal anodizing time was 10 minutes. The sulfuric acid anodic surface of step-type casting showed light yellow while the anodic surface of large piston displayed light royal purple via anodizing under the same condition of 20 minutes of anodizing time, 20 wt.% sulfuric acid concentration and 3 A/dm2 current density obtained from the anodizing treatment of step-type casting. The reason is caused by the chilled zone beneath the surface of large piston. The anodic surface of small piston exhibited lusterless reddish brown due to the larger silicon and aluminum grain on the surface of small piston.

Keywords : A390 aluminum alloy casting、anodizing treatment、sulfuric acid、piston

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