Product Introduction

Anodizing Technology for Aluminum
High corrosion resistant sealing agent 5E161

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Introduction

Anodic oxidation treatment, widely known as anodizing (alumite), is a surface treatment for aluminum alloys. Anodizing generally includes the subsequent sealing process, which improves corrosion and abrasion resistance, and allows for improved design through dyeing, making it a technology widely used in the industrial field.

On the other hand, it has been confirmed that the corrosion resistance of anodizing varies greatly depending on the type of aluminum material. Copper-free expanded materials are easy to obtain corrosion resistance, while die-cast materials such as ADC12 are difficult to obtain corrosion resistance.[1]

We have developed a new sealing agent, 5E161, which provides excellent corrosion resistance in cast and die-cast materials. The technology of this agent is therefore introduced.

Product Description

5E161 is a sealing agent that improves the corrosion resistance of anodic oxide coatings on aluminum alloys. Compared to conventional nickel acetate sealing and boiling water sealing, it offers outstanding corrosion resistance on castings and die-cast materials. Furthermore, it can be processed at lower temperatures and in shorter time.

Features

- Superior corrosion resistance compared to conventional nickel acetate sealing and boiling water sealing.
- Treatment can be performed at 40°C, which reduces energy costs compared to high-temperature treatment.
- Standard treatment time is as short as 3 minutes, making it easy to work with.
- We have a lot of experience in die-casting workpieces that require corrosion resistance.

Treatment Process

5E161 can be used as an alternative to conventional nickel acetate sealing.

Anodic oxidation → (Dyeing) →
Sealing 5E161 → Drying

*Water rinsing is always performed after each of the above treatment processes.

Mechanisms

The anodizing is generally performed in the following steps (Figure 1). First, aluminum alloy material is immersed in a special electrolytic solution to form an oxide film with pores on the material surface by anodic electrolysis. If necessary, the material is dyed in the next process. Finally, a pore sealing treatment is performed to seal the pores.[2]

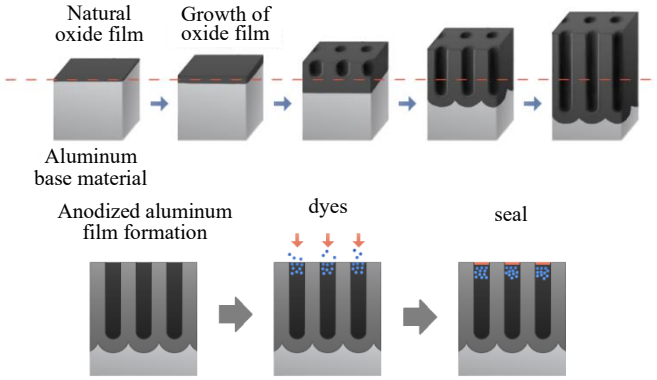

Figure 1: General Anodizing Process

Conventional boiling water sealing and nickel acetate sealing are considered to be hydration sealing, and nickel acetate sealing is further considered to be hydration sealing with nickel deposited as hydroxide.[3]

$Al_2O_3 + H_2O \longrightarrow Al_2O_3 \cdot H_2O$ (Boehmite)

$Ni^{2+} + 2OH^- \longrightarrow Ni(OH)_2$

On the other hand, the new 5E161 is a trivalent chromium- and cobalt-containing agent and is a metal-filled seal. The sealing mechanism is thought to be based on the following

reaction.

$Al_2O_3+6F^-+3H_2O \longrightarrow 2AlF_3+6OH^-$

$Cr^{3+}+3OH^- \longrightarrow Cr(OH)_3$

$Co^{2+}+2OH^- \longrightarrow Co(OH)_2$

The gel portion of the anodized aluminum pore is positively charged, and the negatively charged fluorine ions adsorb and react to produce aluminum fluoride and hydroxide ions. Next, chromium and cobalt ions react with hydroxide ions to form metal hydroxides. These reactions are thought to coprecipitate aluminum fluoride and metal hydroxides and seal pores.

Figure 2 shows the results of glow discharge spectroscopy (GDS) of anodized aluminum material sealed with the new sealant. Many film components were present in the surface layer, and film components were observed deep into the pores (about 3 μm). It is thought that high corrosion resistance is obtained even in castings and aluminum die-cast materials due to the barrier effect of the new sealant 5E161, in which the pore-sealing components fill and seal deeply and the chemical components are also deposited on the surface layer.

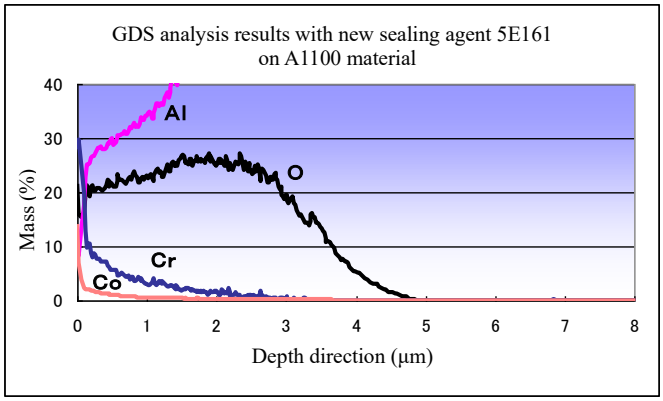

Figure 2: GDS Analysis Results of New Sealing Agent 5E161 Treated Product (trace elements are excluded from the search)

The results of the salt spray test of the new 5E161 and nickel acetate sealing agents are shown in Figure 3. 24 hours of salt spray on ADC12 material with conventional nickel acetate-based sealing agent showed the occurrence of white rust, while the new sealing agent improved corrosion resistance to the extent that only minor white rust was observed after 1200 hours.

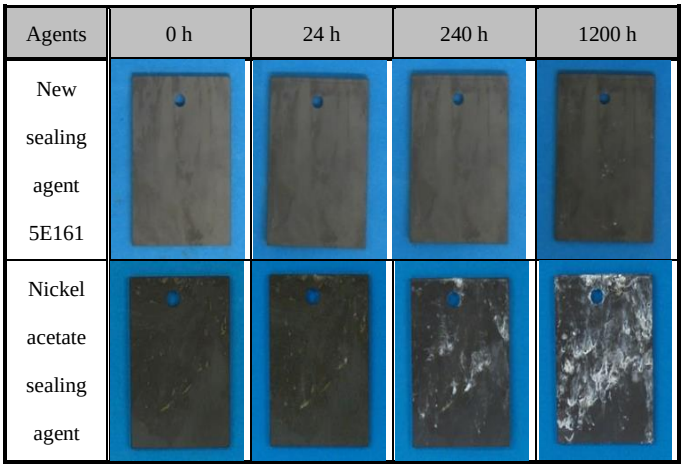

Figure 3: Salt Spray Test Results of ADC12 Material (JIS Z 2371)

In Closing

5E161 is an effective sealing agent, especially for die-cast materials where corrosion resistance is required. Furthermore, compared to nickel acetate-based sealing agents, 5E161 can be processed at lower temperatures for shorter periods of time, and improved productivity can be expected.

When castings are anodized, regardless of the type of sealing agent, they will have a blackish color. For this reason, black staining is often chosen for dyeing castings after anodizing. By using black dye 5E158, which is suitable for this new sealing agent, a black appearance can be obtained even in a short time.

References

1: Japan Research Institute of Material Technology; Hyoumensyoritaisaku Q&A 1000, p.98 (1998)
2: Toshihiko Sato, Kyoko Kaminaga; THEORIES OF ANODIZED ALUMINUM 100 Q & A, p.15 (1997)
3: Japan Research Institute of Material Technology; Hyoumensyoritaisaku Q&A 1000, p.113 (1998)

Product name	Purposes	Mechanism
5E161AB	Sealing agent for aluminum anodic oxide film	Metal-filled seals
5E158	Black dye for anodizing aluminum	Dyes