

## Anti-pitting corrosion aluminum foil **ALSALT®**



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### 【1. Introduction】

Aluminum offers excellent corrosion resistance in moist air due to its tendency to form a thin oxide film over its surface. This oxide layer, however, can be partially destroyed by halogen ions, which initiate localized corrosion known as pitting.

Chloride ions are everywhere around us, in salt and chlorine-based disinfectant, as shown in Table 1. Aluminum foils with better anti-corrosion properties under such environments can be widely applicable to new fields and contribute to lightweight and environmentally friendly products.

Table 1 Chloride ions around us.

Normal saline	Salt	0.9%
Seawater		3.5%
Soy sauce		18%
Chlorine-based disinfectant	Sodium hypochlorite	200ppm

Pitting of aluminum propagates when its matrix acts as anode and the intermetallic compounds act as cathode. This happens because the electric potential is different between anode and cathode. By closing this potential gap, we have developed ALSALT, an aluminum foil which exhibits an excellent anti-pitting corrosion property in a neutral solution with chloride ions.

### 【2. Characteristics】

#### (2-1) Anti-pitting corrosion properties

##### [Resistance to saltwater solution]




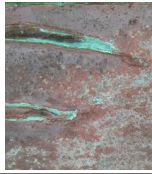




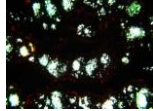
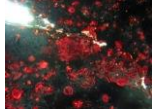


A cyclic neutral salt spray test was conducted on various metal foils including ALSALT. The results are shown in Fig. 1. ALSALT shows lighter surface discoloration and has both less and substantially smaller pitting perforations compared to the general A1230 aluminum foil, copper foil, and stainless foil. Moreover, perforations in ALSALT were smaller than those of the 7 times thicker A1230 foil. This demonstrates that ALSALT suppresses pitting growth as well as the initiation of pitting.

This feature to suppress pitting growth is effective in preventing corrosion at the cut section of foils with protective coatings and films. Fig. 2 shows the appearance of foils coated on both sides after being subject to dipping tests in saltwater. Dissolution at the cut section is significantly suppressed only on ALSALT.

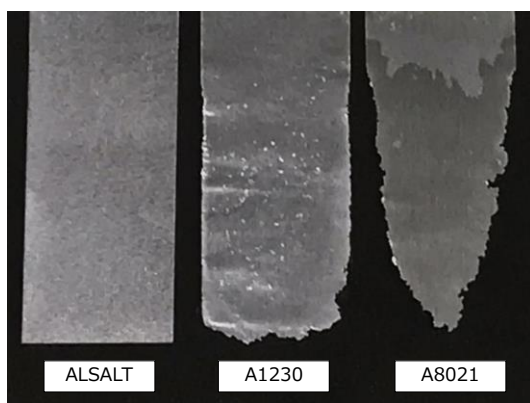
##### [Resistance to hypochlorous acid solution]

Fig. 3 shows the appearance of aluminum foils after in dipping tests exposed to a sodium hypochlorite solution widely used as a disinfectant.

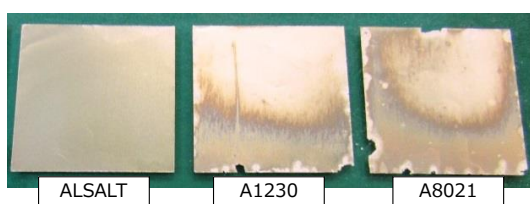
ALSALT shows lighter surface discoloration and its cut section remains undissolved, while heavier discoloration and dissolution occur on the other two foils.

Metal / Alloy	ALSALT	A1230	Electrolytic copper foil	Rolled copper foil	SUS304 foil	A1230
Thickness	12μm		10μm			80μm
Appearance						
Pitting behavior observed by backlight						

**Fig. 1** Appearance after a cyclic neutral spray test (JIS H 8502-8-1) of 200 cycles. (In this test, foils are exposed to environments of salt spray, air drying, and high humidity.)



**Fig. 2** Appearance of foils coated on both sides after dipping tests in saltwater. (35°C · 3%NaCl · pH3 · 72hours)



**Fig. 3** Appearance of foils after dipping tests in hypochlorous acid solution. (30°C · 200ppm · 500hours)

### (2-2) Mechanical Properties

Table 2 shows the mechanical properties of ALSALT and the general A1230 aluminum foil. Compared to the A1230 foil, tensile strength and total elongation of H-temper ALSALT is about the same, and O-temper ALSALT offers higher tensile strength along with the same level of total elongation.

### 【3. Future Prospects】

ALSALT has an excellent anti-pitting property in a neutral solution with chloride ions. This makes it possible to reduce environmental impacts by omitting protective coatings and films, to use thinner aluminum foils and to save weight by replacing other metal foils.

We're now aiming to introduce ALSALT to various industries: food packaging and medical care fields where products are exposed to saltwater, health and sanitation fields where chlorine-based disinfectant is widely used, and construction fields where products are often damaged by seawater.

Table 2 Mechanical properties of ALSALT

Alloy	Thickness [μm]	Temper	UTS [MPa]	Total elongation(%)
ALSALT	20	H	216.0	3.7
A1230	20	H	190.0	4.5
ALSALT	12	O	136.1	5.0
A1230	12	O	68.0	4.1