

# High-Adhesion Aluminum Sheeting: KO Process Sheets

## 1. INTRODUCTION

Surface treatment of aluminum makes it possible to further upgrade film adhesion, adhesive strength and corrosion resistance, and for this reason a variety of chemical treatments, including chromate-phosphate and anodic oxide treatment (alumite processing) have been used. In recent years, however, there have been demands for increases in adhesive strength and calls for materials that are more environment-friendly, raising the hope that new surface treatment materials will be brought forward.

## 2. FEATURES OF KO PROCESS FILM

(1) Is “earth-friendly”, with no constituents that are harmful to man or the environment:

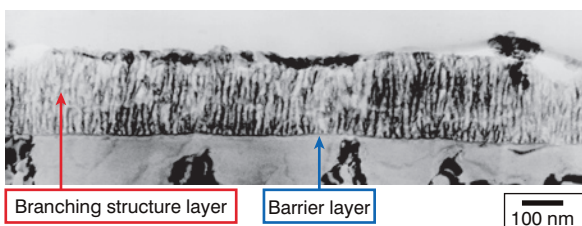
Table 1 compares the constituents of KO process film against others. Since electrolysis is carried out using an electrolyte of degreasing property that includes no chromium or other heavy metals, the aluminum oxide film that is formed contains no heavy metals and is low in surface contamination.

(2) Exhibits a high degree of adhesion:

Figure 1 shows a TEM image of the cross section of a KO process film. By forming an aluminum oxide film having a branching structure it is possible to achieve extremely good adhesion between the adhesive agent and the coating, plus it is relatively free from the effects of heating and processing.

**Table 1 Chemical constituents of selected coating materials.**

	Film composition (mol %)		
	Al	O	Other
KO process film	40.7	58.2	1.1
Sulfuric acid anodic oxide film	32.0	64.0	4.0
Al <sub>2</sub> O <sub>3</sub> (theoretical value)	40.0	60.0	0.0



**Figure 1 TEM image of KO process film.**

(3) Performance is retained over long periods:

An alkaline electrolyte is used and rinsing is done using deionized water, so that there is no residue in the film of acidic constituents that could promote corrosion and the level of impurities such as chlorine is extremely low. Thus virtually no change in performance occurs over time.

(4) High heat dissipation:

KO process film is so thin--less than 250 nm--that the high thermal conductivity of aluminum is not compromised.

## 3. PRODUCT SPECIFICATIONS

Table 2 shows the specifications of KO process sheets. For processing outside this range, please make specific inquiries.

Figure 2 diagrams the KO process. It uses an alkaline electrolyte containing a surfactant, and is characterized by carrying out degreasing and AC electrolysis simultaneously.

**Table 2 Specifications of KO process sheets.**

Aluminum materials	1000 series (A1100P-H24 and the like)
	3000 series (A3003-H18 and the like)
	5000 series (A5052P-H34 and the like)
Outline dimensions	1050 mm square (max.)
Thicknesses	0.5 - 5.0 mm

## 4. PERFORMANCE

### 4.1 Adhesion

Figure 3 shows the 90° peeling strength using polyester tape with acrylic adhesive. It can be seen that the highest peeling strengths are provided by the oxide film surface treatment agents, led by KO process sheets.

High secondary adhesion is yet another feature of the KO process. Figure 4 shows the T-peel strength with a hot-melt type epoxy bond. Compared to the KO process sheets, which suffer only a minor drop in strength due to retort processing (121°C), the drops for sulfuric acid and phosphoric acid anodic oxide treatment agents were enormous.

From this it can be seen that compared to pretreatment methods used in the past to prepare surfaces for adhesives, the KO process delivers high adhesion that is stable even under the most extreme conditions.

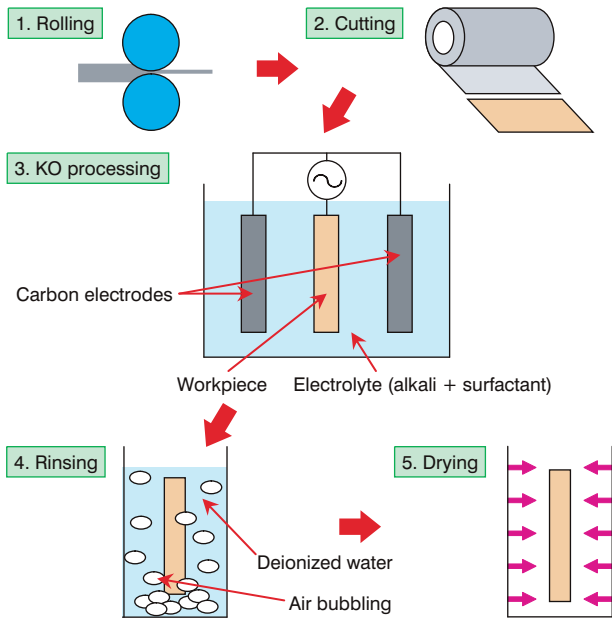


Figure 2 KO process.

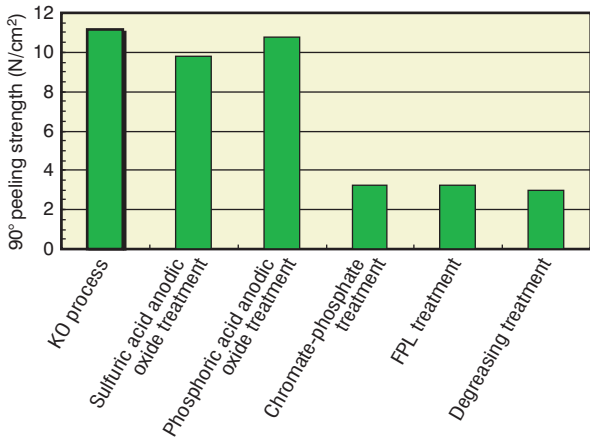


Figure 3 90° peeling strength for selected surface treatments with acrylic adhesive.

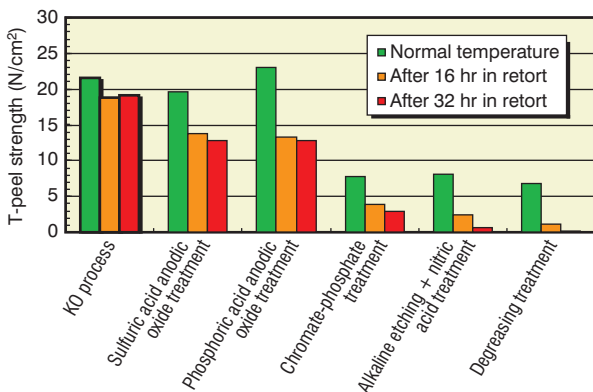


Figure 4 T-peel strength for selected surface treatments with epoxy bond.

4.2 Corrosion Resistance

Figure 5 shows the result of filiform corrosion tests after cathodic electrodeposition coating. The KO process sheets showed shorter filiform corrosion than other chem-

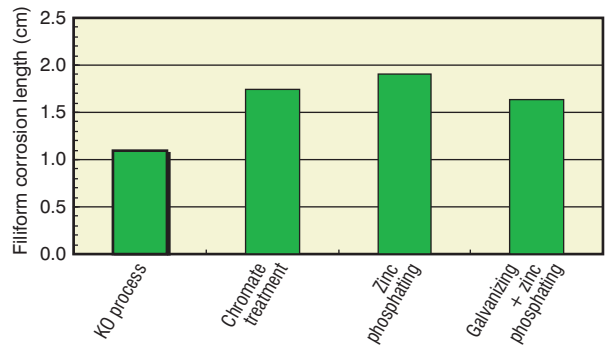


Figure 5 Result of filiform corrosion tests on selected surface treatments.

ical treatment agents for corrosion resistance, and exhibit an outstanding level of corrosion resistance.

4.3 Durability

Figure 6 shows the change in 90° peeling strength using polyester tape with acrylic adhesive for KO process sheets that have been exposed to a humid atmosphere for up to six months.

If ordinary treatment agents are exposed without adhesives or coatings, moisture absorption and surface contamination result in changes in properties, causing a precipitous drop in adhesion strength. KO process material, on the other hand, is mainly composed of aluminum oxide, which is low in impurities, and therefore undergoes virtually no drop in performance.

It is therefore highly suitable for use in components in which degradation in performance is unacceptable and the highest reliability is required.

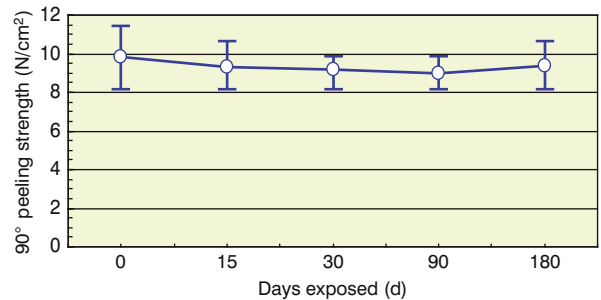


Figure 6 Change in 90° peeling strength for KO process sheets with exposure to humid atmosphere.

5. APPLICATIONS

By reason of their high heat dissipation and high adhesion, KO process sheets have been highly acclaimed for use as aluminum printed circuit boards. In addition their outstanding adhesion properties recommend them for use as construction materials, coated sheeting and compound sheeting that offer excellent visual appeal.

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