

ALPOLICTM A2

High Fire Retardant Aluminum Composite Material



Mitsubishi Chemical Infratec Co.,Ltd.

URL <http://www.alpolic.com>

ALPOLIC™ A2

High Fire-Retardant Aluminum Composite Material

ALPOLIC™ A2 is an aluminum composite material (ACM) with a high fire-retardant core, used as exterior and interior claddings and roof covering in new buildings and retrofit applications. ALPOLIC™ A2 has been classified as a superior fire-safe grade among various types of ACM around the world. The material is manufactured by Mitsubishi Chemical Infratec Co., Ltd. and furnished by approved dealers or distributors.

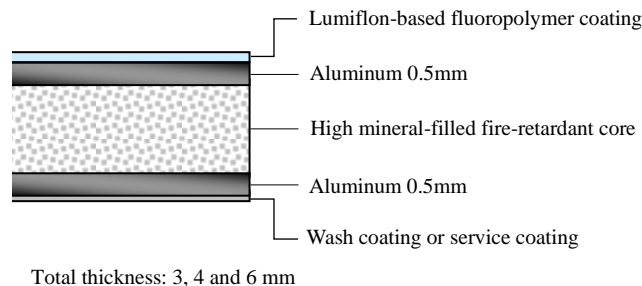
1. Features

ALPOLIC™ A2 has the following features:

- (1) Flatness: ALPOLIC™ A2 has the excellent flatness derived from the continuous laminating process.
- (2) Color uniformity: The coil coating process ensures complete color consistency.
- (3) Rigidity: As one of the attributes of composite panels, ALPOLIC™ A2 is rigid and lightweight. 4mm thick panel is equivalent to 3.3mm thick solid aluminum in rigidity, and reduces the weight by 10%.
- (4) Fire safety: With its high mineral-filled fire-retardant core, ALPOLIC™ A2 has been ranked up to class A2 which is one of highest fire-safe grades in accordance with European Norm (EN) standard.

2. Material composition

ALPOLIC™ A2 is composed of a high mineral-filled fire-retardant core with a very small amount of polyethylene sandwiched between two skins of 0.5 mm thick aluminum alloy (3105-H14). The core of ALPOLIC™ A2 is light gray in color. The total thickness is 3, 4 and 6 mm.



Composition of ALPOLIC™ A2

3. Surface finish

The surface is finished with a high-performance Lumiflon™-based fluoropolymer coating as standard, and the back side is a wash coating or a service coating. ALPOLIC™ A2 is available in finishes of: Solid Colors, Metallic Colors, Sparkling Colors, Prismatic Colors, Pattern Series, Matte Colors and Premium Aluminum series. In these finishes, Lumiflon™-based fluoropolymer paints are applied in manufacturer's continuous coil coating lines.

The back side of ALPOLIC™ A2, which will face the structural wall or steel when it is installed as a cladding panel, has a polyester-based wash coating or a service coating to protect it from possible corrosion problems.

The surface is protected with a self-adhesive peel-off protective film consisting of two polyethylene layers of white and black. According to weathering tests under normal outdoor conditions, the protective film will withstand six months' exposure without losing its original peel-off characteristic or causing stains or other damages.

4. Product dimension and tolerance

- (1) Panel thickness: 3, 4 and 6 mm
 (2) Panel size: Width = 1245, 1270, 1550 and 1575 mm
 Length = less than 7200 mm

Note: Custom width can be accepted between 914 mm and 1575 mm subject to minimum quantity. Please contact local distributors or our office.

(3) Product tolerance

- Width: ± 2.0 mm
 Length: ± 1.0 mm/m
 Thickness: ± 0.2 mm in 3 and 4 mm thick, ± 0.3 mm in 6 mm thick
 Bow: Maximum 0.5% (5mm/m) of the length or width
 Diagonal difference: Maximum 5.0 mm
 Surface defect: The surface shall not have any irregularities such as roughness, buckling and other imperfections in accordance with our visual inspection rules. ALPOLIC™ A2 is supplied with a cut edge and without aluminum sheet displacement or core protrusion.

5. Characteristics

(1) Physical properties

Item	Method	Unit	3mm	4mm	6mm
Specific gravity	-	-	2.14	2.03	1.95
Weight	-	kg/m ²	6.4	8.1	11.7
Thermal expansion	ASTM D696	$\times 10^{-6}/^{\circ}\text{C}$	23	19	23
Thermal conductivity	ASTM C1363, ISO8990	W/(m·K)	0.30	0.63	0.60
Thermal transmittance	ASTM C1363, ISO8990	W/(m ² ·K)	4.80	6.55	4.80
Deflection temperature	ISO 75-2	$^{\circ}\text{C}$	125	110	96

(2) Mechanical properties of composite material

Item	Method	Unit	3mm	4mm	6mm
Tensile strength	ASTM E8	MPa, N/mm ²	61	43	33
0.2% proof stress	ASTM E8	MPa, N/mm ²	56	41	-
Elongation	ASTM E8	%	4.3	3.8	0.0
Flexural elasticity, E	ASTM C393, JIS A1408	GPa, kN/mm ²	Not tested	38.5	35.7
Flexural rigidity, EI	ASTM C393, JIS A1408	k N·mm ² /mm	Not tested	204	-
Punching shear resistance	ASTM D732	MPa, N/mm ²	Not tested	37	33

(3) Impact resistance by DuPont method (ALPOLIC A2 4mm, ASTM D4226 modified)

Steel ball weight (kg)	Height (mm)	Dent depth (mm)
0.3	300	0.2
0.5	500	1.0
1.0	300	1.3
1.0	500	2.1

(4) Mechanical properties of aluminum skin: 3105-H14 alloy

Item	Unit	Aluminum 3105-H14
0.2% proof stress	MPa, N/mm ²	150
Flexural elasticity	GPa, kN/mm ²	70

(5) Sound transmission loss (ASTM E413)

Item	Unit	3mm	4mm	6mm
STC (Standard Transmission Class)	-	27	27	30

(6) Fire performance

ALPOLIC™ A2 has passed a set of fire tests below which is recognized as a standard of fire protection in EU countries:

Country	Test standard (ALPOLIC A2 4mm)	Results & classification
EU	EN 13823, EN ISO 11925-2, EN 13501-1	Class A2-s1, d0

6. Paint finish

(1) Coating system

The surface is finished with Lumiflon™-based fluorocarbon coating as standard; the back side is a wash coating or a service coating. ALPOLIC™ A2 is available in finishes of: Solid Colors, Metallic Colors, Sparkling Colors, Prismatic Colors, Pattern Series (Stone, Timber, Metal, and Abstract), Matte Colors and Premium Aluminum series. In these finishes, Lumiflon™-based fluorocarbon paints are applied in the manufacturer's coil coating lines.

The coating system of each finish is:

A. "Solid Colors" are three-coat three-bake system.

The thickness is 30 microns (1.18 mils) minimum and consists of a conversion coating, an inhibitive primer, a Lumiflon™-based fluoropolymer coating and a clear coating.

B. "Metallic Colors", "Sparkling Colors" and "Prismatic Colors" are a three-coat three-bake system.

The thickness is 28 microns (1.1 mils) minimum and consists of a conversion coating, an inhibitive primer, a Lumiflon™-based metallic coating and a clear coating.

C. "Pattern Series" is coated with a unique image transfer process.

The thickness is 39 microns (1.54 mils) minimum and consists of a conversion coating, an inhibitive primer and a Lumiflon™-based fluoropolymer coating including the image transfer layer. Matte finish is also available.

D. "Matte Colors" are three-coat three-bake system

The thickness is 28 microns (1.1 mils) minimum and consists of a conversion coating, an inhibitive primer, a Lumiflon-based fluoropolymer coating and a clear coating.

E. “Premium Aluminum series” are two-coat two-bake system.

The thickness is 36 microns (1.42 mils) minimum and consists of a conversion coating, a clear or tinted primer and a Lumiflon-based fluoropolymer clear coating.

Note 1: Lumiflon-based fluoropolymer coating has basically a coating warranty for 10 years. However, except Matte Colors and Matte Patterns, 20 year-coating warranty is available subject to several conditions. Please contact local distributors or our office.

Note 2: ALPOLIC™ A2 is finished with Lumiflon™-based fluoropolymer paint as standard, but polyester and other coatings are also available as an option.

(2) Colors and gloss level

Standard colors are provided in the Color Chart. Custom colors are available for all finishes upon request subject to respective minimum quantities. The standard gloss is 30% for Solid and Metallic Colors, and 30-80% for Sparkling Colors, 80 % for Prismatic Colors, 15-80% for Patterns (Stone, Timber, Metal, and Abstract) and 5% for Matte Colors. Premium Aluminum series are available High Gloss and Low Gloss. Custom gloss is available between 15 and 80%, except Premium Aluminum series, upon request subject to minimum quantities. Please contact local distributors or our office for custom color requests.

(3) Coating performance

The Lumiflon™-based fluoropolymer coating meets the following criteria:

Solid Colors, Metallic Colors, Sparkling Colors, Prismatic Colors Patterns, and Matte Colors

General properties

Dry film property	Test method	Criteria
Gloss (60°)	ASTM D523	15 to 80% (Matte 5%)
Formability (T-bend)	NCCA II-19 ASTM D1737	2T, no cracking (except Matte data not available)
Reverse impact-crosshatch	NCCA II-5	No pick off
Hardness-pencil	ASTM D3363	H
Adhesion		
Dry	ASTM D3359	No pick off
Wet	37.8°C, 24 hrs.	No pick off
Boiling water	100°C, 20 min.	No pick off
Abrasive resistance	ASTM D968 (Falling sand)	40 liters/mil
Chemical resistance:		
Muriatic acid, 10% HCl, 72 hrs.	ASTM D1308	No change
Sulphuric acid, 20% H2SO4, 18 hrs.	ASTM D1308	No change
Sodium hydroxide, 20% NaOH, 1 hr.	ASTM D1308	No change
Mortar, pat test, 24 hrs.	AAMA2605	No change
Detergent, 3% solution, 38 °C, 72 hrs.	ASTM D2248	No change

Weatherability

Dry film property	Test method	Criteria
Weather-o-meter test Colour retention: Gloss retention: Chalk resistance:	ASTM D2244 ASTM D523 ASTM D4214	Maximum 5 units after 4000 hrs. 70% after 4000 hrs. Maximum 8 units after 4000 hrs.
Salt spray resistance:	ASTM B117	Blister-10, scribe-8, after 4000 hrs., 35 °C salt fog
Humidity-thermal	ASTM D2246	No blister, no cracking After 15 cycles of 38 °C 100% RH for 24 hrs. and -23 °C for 20 hrs.
Humidity resistance:	ASTM D2247	No change After 4000 hrs., 100% RH, 35 °C

Premium Aluminum series

Table 6-3 General properties

Dry film property	Test method	Criteria
Impact	JIS K 5600-5-3	No pick off
Hardness-pencil	JIS K 5600-5-4	H
Adhesion Dry Wet, 50°C, 240 hrs. Boiling water, 100°C, 8 hrs.	JIS K 5600-5-6 ditto ditto	No pick off No pick off No pick off
Chemical resistance: Sulphuric acid, 5% H ₂ SO ₄ , 24 hrs. Sodium hydroxide, 1% NaOH, 24 hrs.	JIS H4001 (reference) ditto	No change No change

Table 6-4 Weatherability

Dry film property	Test method	Criteria
Weather-o-meter test Colour retention: Gloss retention:	JIS B7753 JIS Z8730 JIS Z8741	Maximum 5 units after 4000 hrs. 50% after 4000 hrs.
Cyclic corrosion resistance	ASTM G85 A.5	Rating No. Area \geq 8, Scribe \geq 7
Humidity resistance	JIS K 5600-7-2	No change After 240 hrs., 95% RH, 60°C

7. Processing method

(1) Cutting/ Saw

ALPOLIC™ A2 can be easily cut using standard woodworking saws (i.e. circular hand saw or panel saw).

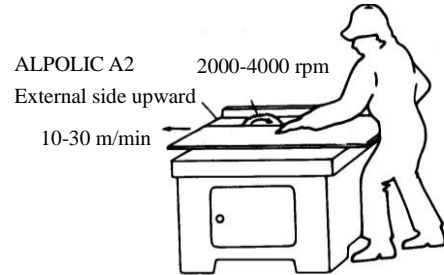
A carbide tip blade made for a light metal is suitable for cutting ALPOLIC™ A2

Example of suitable saw blade:

Blade diameter	255 - 305 mm
Number of teeth	80 - 100
Cut width	2.0 - 2.6 mm
Rake angle	10°
Tip	Carbide

Operating conditions

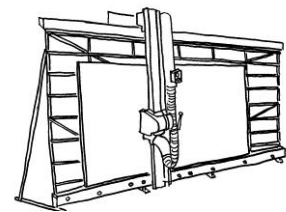
Spindle of circular saw blade	2000 - 4000 RPM
Feed rate	10 - 30 m/min



Circular hand saw

Notes on saw cutting:

- Do the cutting operation with the external side facing upward to prevent the panel from scratches and the protective film from peeling off.
- Remove cutting chips from ALPOLIC™ A2 carefully after cut, to avoid dents during storage and assembly.
- Sharpen or replace the saw blade, when it becomes dull. Dull blades will result in a large burr or distortion at the cut edge.
- Due to high mineral content in the core, the blade life is shorter than cutting other ALPOLIC™s.

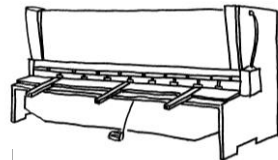
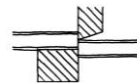


Panel saw

(2) Cutting/ Shear

Square shear cutting is the easiest method for cutting large panels. Some shear droop may result at the cut part of the surface aluminum. Recommended clearance and rake angle for shear cutting is as below.

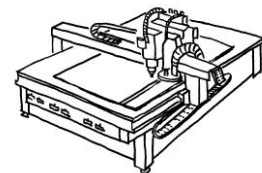
Clearance	0.04 - 0.1mm
Rake angle	1° 30'



Cutting by shear

(3) Cutting/ CNC router

We can also use CNC router for profile cutting ALPOLIC™ A2 panels. Complicated profile cutting as well as strait cutting is possible with CNC router. Use square end mill tools made of solid carbide.



CNC router

(4) Grooving/ CNC router

We recommend a CNC router for grooving for precise grooving depth. The remained thickness should be between 0.65 to 0.75 mm including protective film thickness.

Notes on grooving:

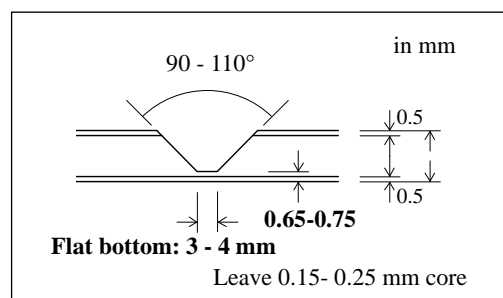
- Conventional panel saws and/ or handy grooving machines may be difficult to control precise grooving depth.
- Slight surface distortion can be seen due to the remained core on the groove.



Grooving with CNC router

U-groove shape

The diagram on the right shows a typical U-groove shape suitable for folding ALPOLIC™ A2 panels. It is important to leave 0.65 to 0.75 mm thick in total on the grooves including protective film. We recommend 90 to 110° angle grooves with 3 to 4 mm flat bottom for 90° bending.



Typical U-groove shape

Operating condition of CNC router

A CNC router enables efficient and precise grooving. Typical conditions are as follows:

Router bit

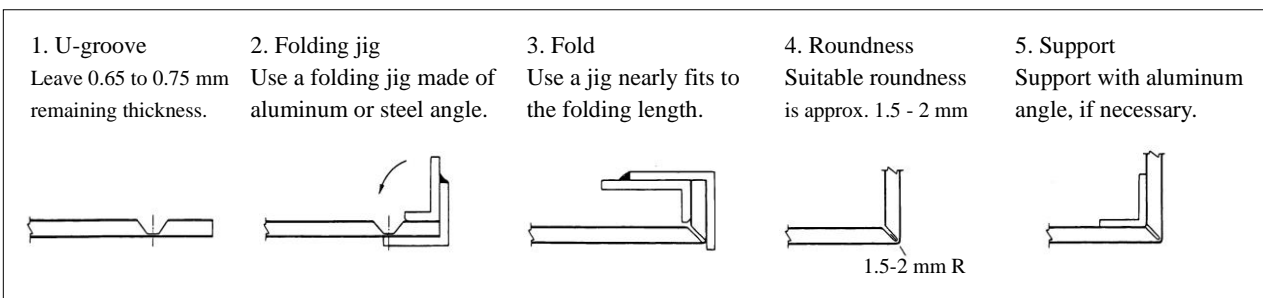
Number of teeth	2 - 4
Material	Carbide tip

Operating conditions

Spindle	12,000 - 24,000 RPM
Feed rate	5 - 8 m/min.

(5) Folding and assembly

After U-grooving, we can fold ALPOLIC™ A2 with a folding jig. The typical folding procedures are as follows.



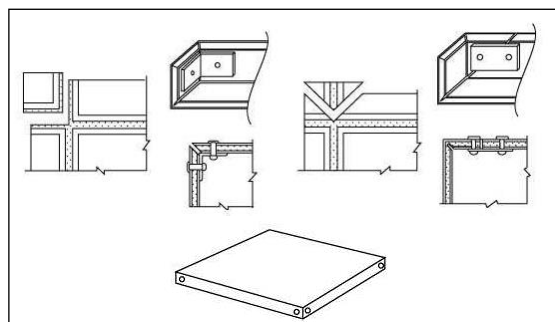
Folding procedures

Notes on folding:

- Fold ALPOLIC™ A2 panels on a flat and rigid worktable, because, if we fold a warping panel, the folding centerline will not be straight.
- The folded corner should have a suitable roundness of approx. 2 mm in radius. If the roundness is too small, the coating may have a crack on the folded corner. Check your U-shape and grooving depth.
- Cracks may take place when we carry out the folding work at a low temperature. Have your folding work at 10°C or higher.
- Folding after U-grooving entails slight elongation. The elongation is 0.5 - 1.0 mm per fold. Pre-adjust the position of the grooving line in your fabrication drawing.

Assembly

To produce a tray type panel (rout & return panel), we normally groove the panel at 25mm from edges, remove the four corners with notching tool and fold the four sides. After assembly, the corners are sealed with sealant from backside to prevent from water penetration, if necessary.



Assembly after grooving

(6) Drilling, punching and notching

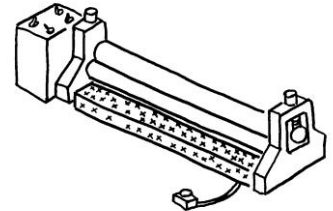
ALPOLIC™ A2 can be processed in the same manner as other ALPOLIC™s by conventional tools or machines. Please refer to ALPOLIC™ Technical Manual for the details.

(7) Bending

Bendability of ALPOLIC™ A2 is limited larger radius only.

Bending with 3-roll bender

We can use 3-roll bender for curving ALPOLIC™ A2 panels. The smallest bendable radius ALPOLIC A2 4mm is approx. 600mmR. The gap between rolls should have some allowance (approx. 0.5mm) in order not to constrict ALPOLIC™ A2 panel between rolls. Please refer to ALPOLIC™ Technical Manual for further details.



3-roll bender

Note: Bending for small radius by means of press brake is not applicable due to less flexibility of the high mineral content core.

(8) Other processing methods

Turret puncher: It is applicable for making fastening holes prior to assembling.

Note: A perforated panel or an exposed cut-edge application is not applicable for ALPOLIC™ A2.

Water-jet cutting: A plunge cut (piercing at the starting point) in water-jet cutting may cause a certain degree of de-lamination between the aluminum skin and the core material.

Laser cutting: According to our tests, we have so far concluded that ALPOLIC™ A2 is not suitable for laser cutting, because the fumes generated from ALPOLIC™ A2 might harm the sophisticated optical instrument in the laser system.

(9) Safety precautions on fabrication works

- The panel edge is sharp and burred. Wear gloves for safety in handling ALPOLIC™ A2.
- During working with CNC router, wear safety glasses for protection of eyes.

8. Joining methods

Joining methods can be followed in the same manner to ALPOLIC™s except the non-penetrating riveting method (acro-rivet system) and core welding. Please refer to ALPOLIC™ Technical Manual for further details.

9. Handling and storing

Refer to the ALPOLIC™ Technical Manual.

10. Cleaning

Refer to the separate cleaning instruction in ALPOLIC™ Technical Manual.

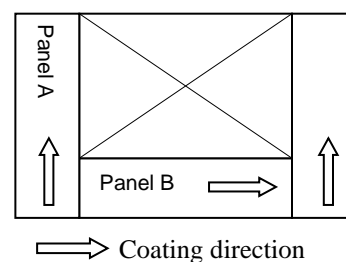
11. General notes (Very important!)

(1) Color consistency

For best color consistency, consider and maintain panel directionality during all stages of job planning, fabrication and installation. Material should be ordered at one time and one width and lots should not be combined.

(2) Coating direction

In Metallic Colors, Sparkling Colors, Prismatic Colors and Patterns (Stone, Timber, Metal, and Abstract), slight color differences will be noticeable if the panels are installed in different directions (like Panel A and B in the diagram). Install panels in the same direction as marked in the protective film. In our Solid Colors, any color difference due to coating direction is negligible.



(3) Protective film

The protective film on ALPOLIC™ A2 consists of two polyethylene layers of white and black. Do not peel off the protective film during fabrication and installation to protect the surface from scratching and soiling. Under normal weather conditions, the protective film will withstand 6 (six)-months of outdoor exposure without losing any of its original peel-off characteristics or causing stains or other damage. However, peel off the protective film as soon as possible after completion.

(4) Gloss increase due to plasticizer

Do not stick, put or apply PVC tapes, polyurethane sealant or modified silicone sealant onto our protective film. The plasticizer contained in these materials can permeate the protective film and cause a gloss change in the coating.

ISO 9001 Certified

The production of ALPOLIC™ A2 is ISO 9001 compliant throughout the design, development, manufacture and sales.

ISO 14001

ALPOLIC™ A2 is produced in plants that have ISO14001 certificate.

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