

Ultra Thin Copper Foil with Carrier Foil (Heat-Resistant Peelable Copper Foil) “F-HP”

1. INTRODUCTION

Recently, mobile devices such as mobile phone etc. are reducing in size and thickness, therefore printed circuit board and semiconductor packages are required to be smaller and thinner. To meet this technological trend, a high density circuit wiring based on fine pitch patterning is developed, and circuit wiring with width narrower than 30 μm are necessary. A thin and smooth copper foil is required to properly form such a fine pattern circuit.

The conventional subtractive process has a tendency to form trapezoidal cross section circuit geometry in fine pattern. Instead of this process, a fine patterning by semi-additive process is developed. In this process, copper is plated only on circuit wiring sections to increase copper thickness. And copper foils between circuit wirings are removed by dissolving. Therefore, a thin copper foil is necessary to reduce volume to be dissolved.

2. FEATURES

Furukawa Electric has been selling F-WS foil as a fine pitch pattern copper foil, however copper foil thinner than 9 μm has been a problem from the user’s handling point of view. On the other hand, a copper foil thinner than 3 μm is necessary when wiring widths are narrower than 30 μm , as shown in Figure 1. To solve this problem, the ultrathin copper foil with carrier foil, shown in Figure 2, was developed. A release layer is formed on a support foil (carrier foil) for handling on circuit forming. And, the ultrathin copper foil with 2 to 5 μm of thickness is formed on the release layer.

The main features of “F-HP”, which is our commercial product, are shown in Table 1. “F-HP” has following features in comparison with our another peelable copper foil with carrier “F-DP”.

- 1) A flat and smooth copper foil with thickness of 2 to 5 μm , suitable for fine pitch patterns.
- 2) An ultrathin copper foil maintains the peeling performance at pressing temperature higher than 300°C.
- 3) A suitable surface treatment can be applied based on customers requirements.

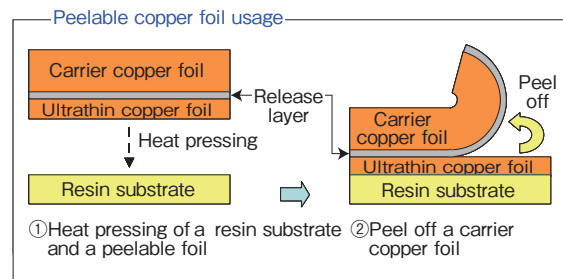
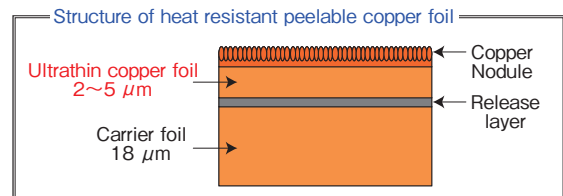


Figure 2 F-HP configuration and usage.

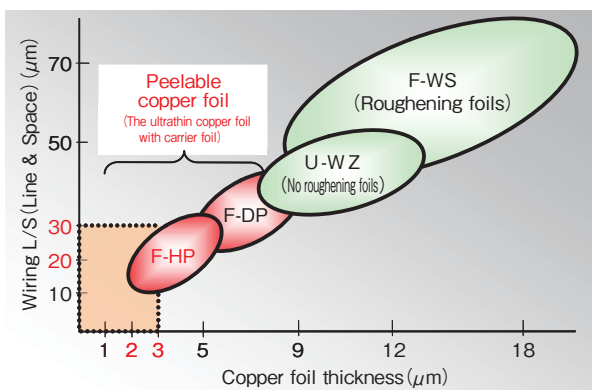


Figure 1 Copper foil thickness required for fine pitch pattern forming.

Table 1 Major features of F-HP.

	Items	Features
Ultra thin copper foil	Thickness	2, 3 (,5) (μm)
	Release layer side surface roughness Rz	0.8~1.8 (μm)
Carrier foil	Thickness	18 (μm)
Surface treatment	Roughening	Selectable
	Before heating	≤0.02 (kN/m)
Carrier peeling strength	After press heated (180°C×90 min.)	Peelable: ≤0.03 (kN/m)
	After press heated (300°C×10 min.)	Peelable: ≤0.03 (kN/m)

3. CHARACTERISTICS

3.1 Flatness and Smoothness

The surface profile of the ultrathin copper foil, after the carrier foil peeling off, is shown in Figure 3. A carrier foil side surface of the ultrathin copper foil is very flat and smooth. Then both linearity at wiring tip and rectangularity at wiring cross section are kept in good shape, after wiring finer than 30 μm. Therefore, the ultrathin copper foil is suitable for fine pitch patterning.

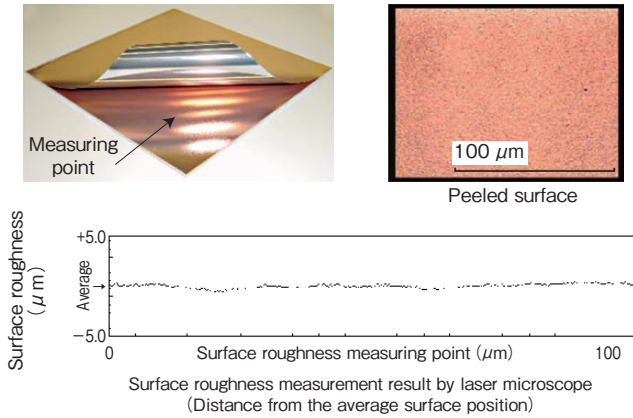


Figure 3 Measurement result for surface profile of ultra thin copper foil.

3.2 Heat Resistance

The carrier peel strength is measured after pressing for one hour with a range of temperatures Figure 4. F-DP is designed to be applied on epoxy resin substrate material. Therefore, the lamination on resin base material, with pressing temperature higher than 200°C, induces high carrier peeling strength as shown in Figure 4. And, some difficulty is experienced when peeling off the ultrathin foil from carrier foil.

Recently, more often, the heat resistant resin with high glass-transition temperature (Tg) is applied on a circuit base with reduced-size high density wiring package. F-HP is applicable to the high Tg resin, and maintains the stable peeling strength for heat resistant resin with press temperature higher than 300°C.

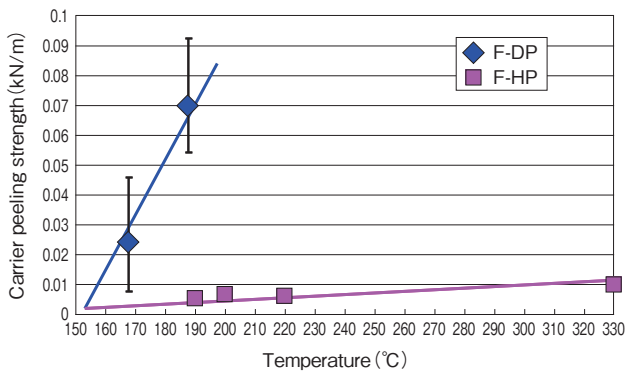


Figure 4 Relation between pressing temperature and carrier peeling strength.

3.3 Surface Treatment

A surface treatment, applied on the surface to be pressed onto resin substrate, can be selected from several kinds of treatments, depending on a given application. For instance, big coarsened particle surface treatment for higher adhesion with resin, low coarsened or non coarsened surface treatment to form extremely small wiring, are available.

The examples of surface roughening treatment on the resin pressing side of the ultrathin copper foil, with several sizes of copper nodules, are shown in Figure 5.

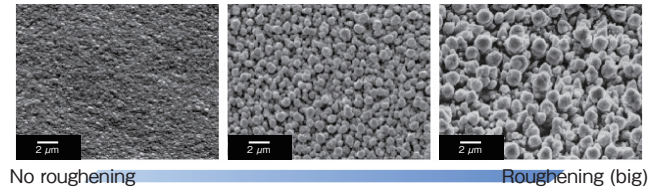


Figure 5 Examples of Surface treatment results by various copper nodules.

4. IN CONCLUSION

The ultrathin copper foil with carrier foil (the heat resistant peelable copper foil) F-HP is a flat and smooth ultrathin copper foil which is suitable for fine pitch forming. This is fabricated using the additive method and has an excellent performance for application on heat resistant resin which requires pressing temperature higher than 300°C.

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