About FPC and FCCL

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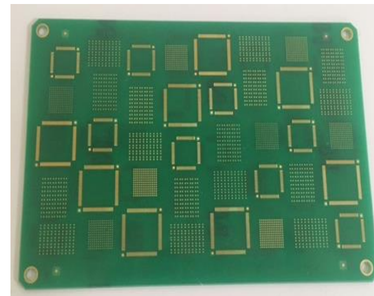
1. What is FPC？

FPC（Flexible Printed Circuits）：
FPC is a type of printed circuit board.
Since it is lamination of a copper foil and a base film (plastic film) , flexible and can be repeatedly deformed.
Even if it is deformed, there is no problem in performance as a circuit. On the other hand, the rigid board is hard and does not bend. (Generally, this is called a printed circuit board.) The FPC is thin and suitable for use in folding and moving parts, making it an indispensable member for the miniaturization, weight reduction, and thinning of all electronic devices such as smartphones, televisions, and laptop computers today.

FPC



Rigid board

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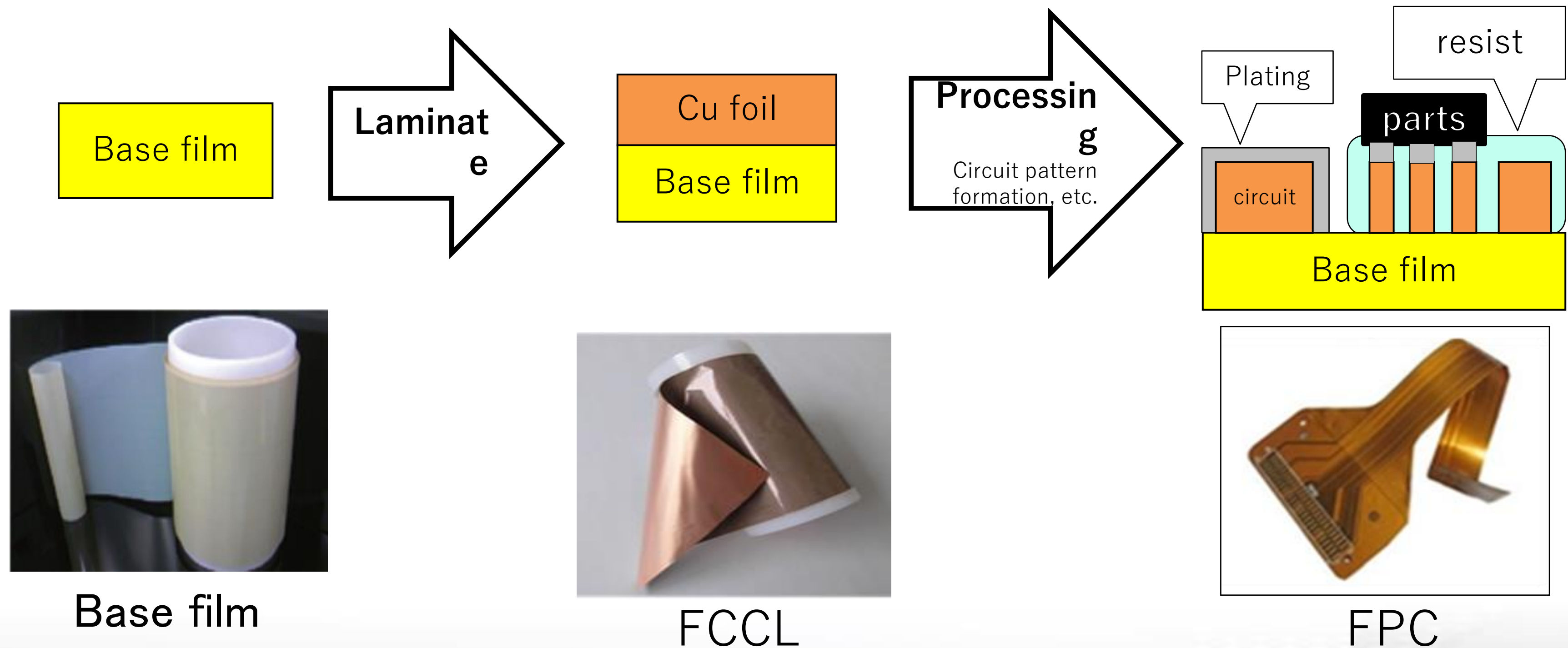
2. What is FCCL？

FCCL（Flexible Cupper Clad Laminate）：
It is a material for FPC in which a thin copper foil and a base film are laminated. FPCs are manufactured from this material through a number of processes such as circuit pattern formation, printing, mounting of parts, punching etc..



Base film

FCCL

FPC

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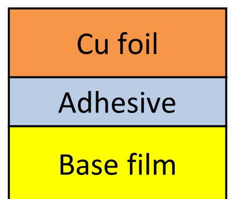
2. What is FCCL？

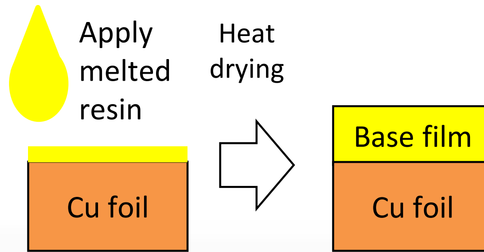
There are four types of FCCL manufacturing methods.

Method		Feature
laminate	Laminate base film on the copper foil with an adhesive.	High material selectivity. Convenient. Since it uses an adhesive, it is inferior in heat resistance, dimensional stability, and flexibility.
casting	The melted resin is coated on the copper foil.	Both equipment and technology are difficult. Thin and good adhesion. Double-sided CCL is not possible.
Sputtering	Sputter copper onto the base film.	Thin and good adhesion, but poor productivity and high cost (especially when trying to thicken). Flexibility is low because it is too thin.
Plating	Plate base film with copper.	Low cost and high productivity. Since it is thin, low adhesion and bending resistance, and requires pretreatment of the film. Double-sided CCL is easy to produce.

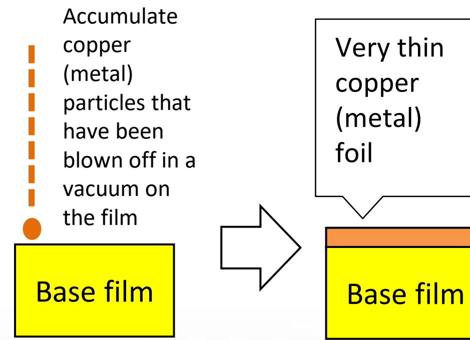
Note: These are images



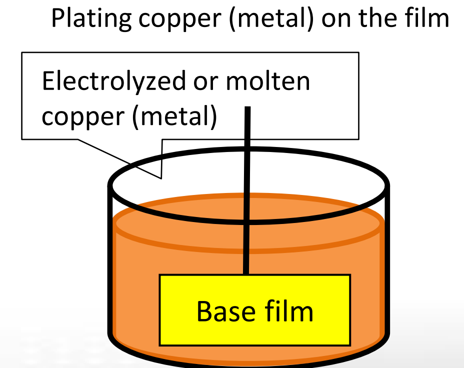
Laminate



Casting



Sputtering



Plating

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2. What is FCCL？

Properties of each FCCL manufacturing method

Property	laminate	casting	Sputtering	Plating
Heat-resistant	Average	Good	Good	Good
Adhesion to metal	Average	Good	Good	Average
Flexibility	Average	Good	Average	Average
Low dielectric property	Average	Good	Good	Average
Cost	Low	High	Very high	Low

Good ＞ Average ＞ Poor

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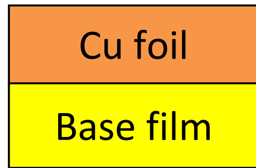
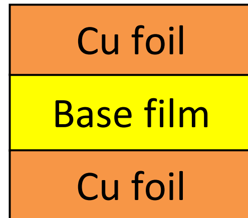
2. What is FCCL？

Two types of FCCL



Single sided FCCL



Double sided FCCL

Property	Single sided FCCL	Double sided FCCL
Heat-resistant	Good	Average
Flexibility	Good	Average
Low dielectric property	Good	Average
Design flexibility	Average	Good
High density integration	Average	Good

Good ＞ Average ＞ Poor

Single sided FCCL can be made by all manufacturing methods such as laminating, casting, sputtering and plating.
Although it depends on the manufacturing method, it has excellent heat resistance, flexibility, and low dielectric properties compared to double sided FCCL, and is used when the above characteristics are not satisfied by double sided FCCL..
The double sided FCCL is mainly made by laminating or plating. (Casting is technically difficult and sputtering is possible, but the price jumps.)
When FPC is used, circuits can be formed on both sides (the front and back can be connected), so the degree of freedom in designing the circuit is high, and high integration is possible. High integration is also possible.

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3. Base film used for FCCL

Three main characteristics required for the base film (plastic film) used in FCCL.

Heat-resistance: Heat resistance that can withstand the solder reflow temperature (250 ° C), dimensional stability at high temperatures. (excluding FPC applications without soldering)
Adhesion to metal: Strength and adhesion to withstand repeated bending and fine pitch machining on high-density wiring.
Low dielectric property: Performance as an insulating film
(The higher the permittivity, the greater the loss of electrical signals)

Main characteristics required for the base film

- Heat resistance
- Adhesion to metal
- Low dielectric property

Resin used for base film and each characteristic

Property	LCP	PI	Olefin	FR-4	Fluorine resin
Heat-resistant	Good	Excellent	Poor	Good	Good
Adhesion to metal	Average	Average	Average	Good	Poor
Low dielectric property	Good	Average	Good	Poor	Excellent

Excellent > Good > Average > Poor

PI is mainly used, but efforts are underway to make up for new materials and the shortcomings of each material.

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End of presentation

User is responsible for determining whether the KGK product is fit for a particular purposeand suitable for user's method of application. Please remember that many factors canaffect the use and performance
of a KGK product in a particular application. The materials to be bonded with the product, the surface preparation of
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whether it is fit for a particular purpose and suitable
for the user's method of application.
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KGK Chemical Corporation.
940 Minaminagai Tokorozawa-City saitama-Pref
359-0011 Japan
Tel： +81 4 2944 5151
Mail： info-k@kgk-tape.co.jp
URL： https://www.kgk-tape.co.jp/

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