

Trend of Requirement to FPC Materials

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Introduction of FPC (Flexible Printed Circuits)

FPC has the flexibility, light and thinness, which is suitable for compact electronics and thereof. The market is growing every year. Because of the dominant role IT plays in the consumption of FPC, its development and growth strongly influences the growth of the FPC market. The market capacities for FPC from 1999 to 2001 and expected capacities from 2002 to 2004 in Japan are shown in figure 1. In 1999, about 202 billion yen of FPC was consumed. In 2000, Japan production of FPC was 244 billion-yen. Because of IT recession in 2001, consumption of FPC decreased to 204 billion yen. Single-sided type is most used, accounting for 61%. With the demand increase of cellular phone, PC, around device related to IT, and DVD, in 2004, the demand of FPC will be expected to 248.8 billion yen in Japan.

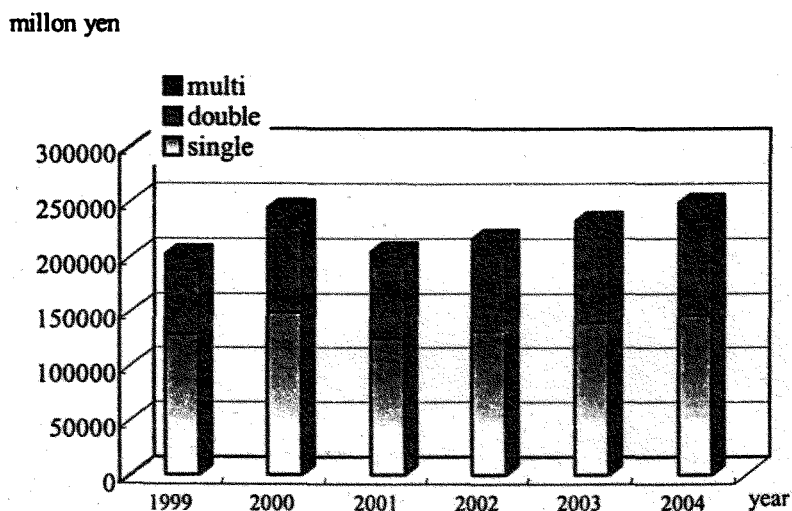


Figure 1 Capacities and expected capacities for FPC in Japan

Nippon Mektron, Ltd. is the largest manufacturer producing flexible printed circuit (FPC) in the world. With the most advanced high technology, we can seize the market demand immediately and punctually. Nippon Mektron has been producing three type FPC, as shown in figure 2, single-sided, double-sided, and multi-layer FPC. In 2001, as

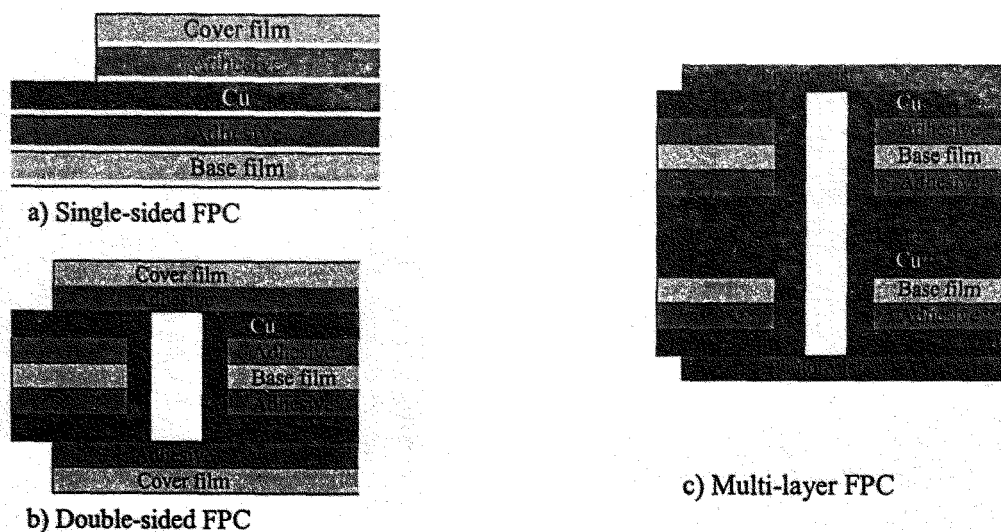


Figure 2 The main products of Nippon Mektron

shown in figure 3, we share 36.8% totally for FPC in Japan, 33.1% for single-sided type area, 40.3% for double-sided type area and 55.2% for multi-layer type area. Nippon Mektron, Ltd.. becomes the largest FPC manufacturer in the world by Printed Circuit Fabrication magazine.

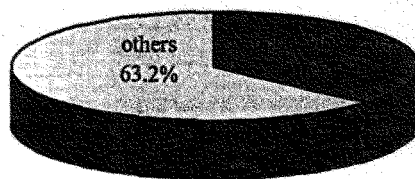


Figure 3 The share of Japan Market for FPC

In this presentation, from the point manufacture of FPC, the requirements to FPC materials are discussed, and higher performance materials with low cost are expected.

Application of FPC

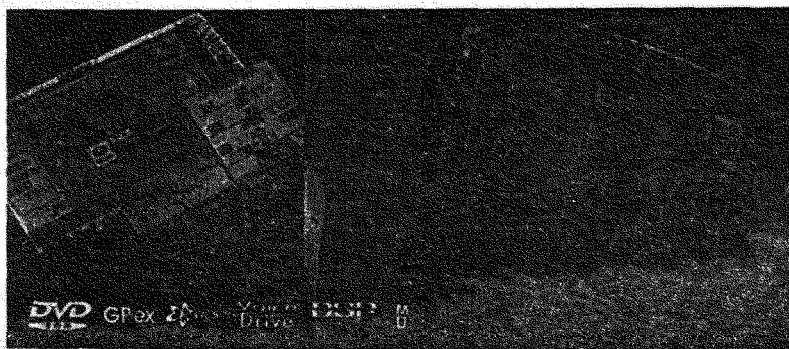
Concerning the application of items, FPC is used mainly as the follow examples.

1. Computer hardware

PC, HDD, FDD, Printer, Display, Peripheral device

2. Car navigation

- 1) Operation switch
- 2) LCD parts
- 3) Photo pick
- 4) Motor part
- 5) Flex part
- 6) Sensor parts
- 7) Connection cable



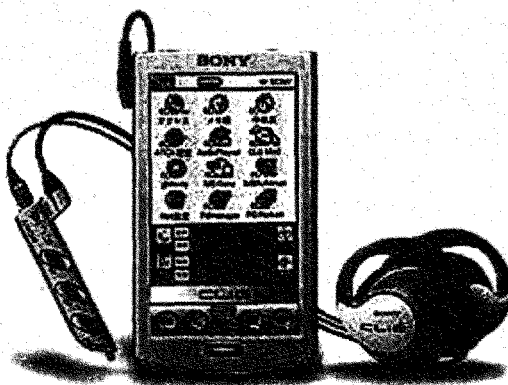
3 Cellular phone

- 1) LC/Backlight parts
- 2) Battery parts
- 3) Hinge parts (flexible)
- 4) C-MOS/CCD parts
- 5) Numeric key pad/side parts



4 PDA

- 1) Earphone jog
- 2) Touch panel
- 3) S/W substrate joint
- 4) Joint for outside
- 5) LCD part
- 6) Backlight joint
- 7) Main/sub substrate



Requirement to FPC materials

In the fine pitch FPC application, polyimide films are required to have high dimensional stability, low water absorption and thermal linear expansion coefficient, excellent heat resistance, outstanding mechanical properties and electrical properties etc.. At the same time, Cu foil should have low profile.

1) Cover lay

Cover layer is composed of polyimide film and adhesive. With the development of higher density assembly, photo-sensitive cover-layer (PSC) for high accuracy assembly, dimensional stability (residual stress, moisture proof, heat proof etc.) and flexibility and laser pouching are required. Environmental problems are becoming more and more important. Halogen-free adhesive is also needed. Though replacing halogen fire resistant additives by others has developed.

2) Base material

Base material is consisting of Cu, adhesive and polyimide film. PI film should have high dimensional stability, low water absorption and thermal linear expansion

coefficient, excellent heat resistance, outstanding mechanical properties and electrical reliability. For this demands in FPC applications, higher heat resistance and low ionic impurities adhesives instead of varieties of conventional non-polyimide thermosetting adhesive, or non-adhesive type FPC are strongly needed. For this polyimide, adhesive to Cu is demanded. As the trend higher performance, smaller size, lighter weight and fine patten FPC in electronic and electronic fields, higher performance materials are strongly needed.

3) Interlayer adhesive

The trend to light, high function, high density, high reliability is necessary for electronics, multi-layer FPC can satisfy the above characteristics. Our multi-layer FPC (Flexboard) has the high through hole reliability, which derive from the good performance interlayer adhesive.

Summary for materials characteristic

FPC	Characteristic
Cover-lay	flexibility, fine pitch dimensional stability halogen-free Pb-free
Base material	dimensional stability low water absorption mechanical properties excellent heat resistance electrical reliability adhesive to ACF high density flexibility thinness fine pitch halogen-free, Pb-free
Interlayer Adhesive	halogen-free, Pb-free low water absorption high young modulus electrical reliability through hole reliability through hole plating