Polyimide Industries in Japan

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1 Introduction

As the trend toward higher performance, smaller size, lighter weight continues coming 21 centuries in electric and electrical field. The conventional materials haven't been able to apply to these devices. Because of this trend strongly influences to semiconductor equipment ,Printed Circuit Boad field and electrical products and so on, the demand for excellent polyimide materials tend to expand in the field of semiconductor, package , liquid crystalline products.

Applying for such field, UBE has been developed kinds of polyimide materials ,such as UPILEX-S, Copper Clad Laminate(Films), UPIMOL(Molding Compounds), UPIFINE, UPICOAT, UPITITE (Vanishes). In addition to these products, UBE has been developing current polyimide materials , porous polyimide, polyimide foam, thermosetting polyimide, in order to apply for various kinds of applications.

In this lecture, we indicates current polyimide industries such as Market, Application , developing materials , trend and future .

2. Marketing for polyimide

Polyimide film with notable properties such as ultra high-heat resistance , high Volume Resistivity , low dielectric constant are mainly supplied by Du Pon't-TORAY, UBE and KANEKA[1].

Table.1 Market Share of polyimide film

Polyimide Maker	Brand Name	Sales (t)	Component Ratio(%)
DU PON'T-TORAY	KAPTON	600	60
UBE	UPILEX	230	23
KANEKA	APICAL	170	17

Result for polyimide sales was shown in Table.1. Market share of polyimide film DuPon't-TORAY supplies 60% among three companies, UBE shares 23% and KANEKA shares 17%.

Concerning of application items, polyimide film was used as FPC,TAB –tape and LDC tape[1]. Another applications were exhibited in Table.2. We expect wide range of applications owing to its outstanding features .

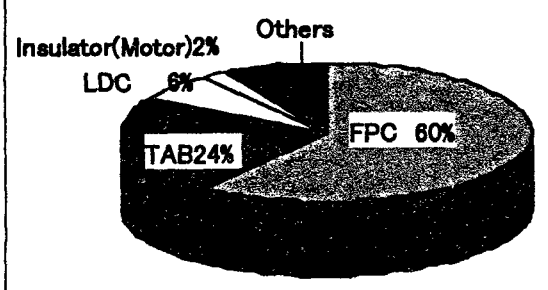


Fig.1 Application items for Polyimide film

Forecasting market scale for non-adhesive type

FPC, example of application for polyimide film , the scale of the market will grow with years[2] .

Table. 2 Application example for Polyimide

Application Example	
(1) FPC	(7) Flexible substrate for batteries
(2) TAB	(8) Cryo-Materials
(3) IC Package	(9) Adhesive Tape
(4) LDC Tape	(10) Moldings
(5) Inslator for Motors	(11) Overcoat as Inslation
(6) Cover material for wire	(12) Under filler

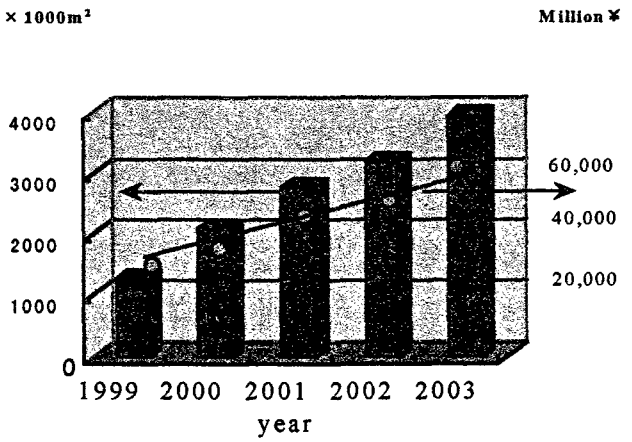


Fig.2 Forecast of marketing scale for non-adhesive type FPC

3. Applications of Polyimide(In case of UBE Industries)

UBE has designated its polyimide development as one of new core project and kinds of products have been developed until now.

Polyimide films (UPILEX-S)

The superior properties of polyimide films, UPILEX-S made of biphenyltetracarboxylic dianhydride (BPDA) and aromatic diamines, with excellent heat resistance, outstanding mechanical characteristics, one of the highest volume resistivity and smaller values in both heat shrinkage and thermal linear expansion coefficient enable to use in FPC(flexible Printed Circuit) and TAB- tape (Tape Automated Bonding) substrates .

Polyimide films (UPILEX-VT)

Recently , demand for the non-adhesive type substrates have been taken place, because using adhesive makes go down excellent properties of polyimides and unable to produce lighter and thinner devices. Accordingly, UPILEX-VT are added heat lamination capability with various foils ceramics without adhesive , give non-adhesive type copper clad laminate (UPISEL) for BGA and CSP substrates.

Another applications

(1)COF (2)Rigid flex (3)MCM-L (4) Malti-layer boards (5) Boards for automobile

(6)Shield Material (7)HDD suspension

Polyimide moldings(UPIMOL)

For the excellent heat and plasma resistant molding application UPIMOL exhibits exceptional properties as well as polyimide film products. The features of UPIMOL are below.

(1) Super high heat resistance(heat distortion temperature: 470℃)

(2) Excellent plasma resistance

(3) Lower out gas

(4) Good processability

(5) Very low impurities

(6) Low water absorption

The notable properties of UPIMOL lead various kinds of applications.

(1)Semiconductor production equipment parts (2) Vacuum equipment parts

(3) Precisely processed parts

(4) Heat and chemical resistant gasket and sealing materials

Polyimide Coatings (Vanishes)

We have been developed several kinds of Polyimide vanishes which enumerate below.

(1) UPIFINE ST : High Heat Resistnce Type

(2) UPIFINE GC :Transparent Type

(3) UPIFINE LT :High Content Type

(4) UPIFINE FP :Encapsulation Materials

(5) UPIFINE AF :Low Viscosity Type

(6) UPICOAT : Flexible Overcoat inks

(7) UPITITE : Heat Resistnce Adhesive

4. New Polyimide Materials(Under Developing)

UBE has succeeded in developing the newly polyimide materials with its own methods and introduce some of them .

(1)Porous Polyimide

It is the first time to produce polyimide film internal structure consists of homogeneous communicating pores pass through the direction of cross section and same hole diameter with excellent polyimide properties . The profile of the

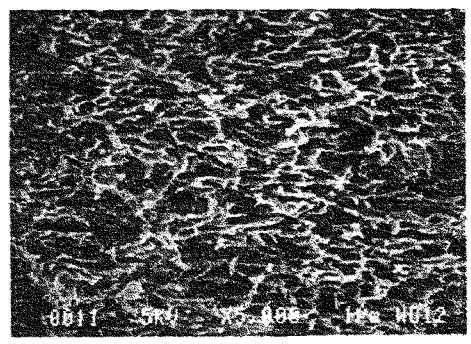


Fig.3 SEM Profile of porous polyimide

porous polyimide were shown in Fig.3 . This material has special features .

(1)Homogeneous communicating pores

(2) Same hole diameter(range :0.01～5 μ m)

(3)Wide range porosity factor (30～80%)

(4)Able to control air permeability

UBE expects to develop various applications including separators for heat resistant batteries , electrolytic capacitors , air-water and another separating materials, carriers for metallic particles and low dielectric constant substrate.

(2) Carbon Materials

Carbon materials derived from polyimide are useful for kinds of applications , being developed as devise for solar battery and electrode of battery.

(3)Polyimide Foams

The newly polyimide foams are expected to develop as heat-resistant retaining material

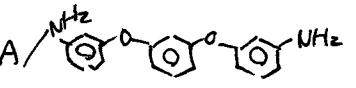
(4)Additive Type Polyimide(Thermo-setting Polyimide)

UBE have developed additive type polyimide as varuous kinds of shapes with polyimide properties. The advantage point for its materials is easy to treat in case shaping.

5. REFERENCES

1) Fuji Chimera Reserch Institute, Inc., '98 Kinousei Koubunnsi no Genjyou to Syouraitennbou' 169 (1998)

2) Fuji Chimera Reserch Institute, Inc., '99 Erekutoronikusu Jissou Nyu-materiaru binran' 199 (1999)

Thermoplastic aBPDA/ 

UPILEX-S' sBPDA/PDA