

Phosphorus-containing Polyimides (II)

Satoru Nanba(難波悟)*, Katsuhiko Sakamoto(坂本勝洋), Shinsuke Inoue(井上進介),

MANAC Inc., Research Laboratory

92 Minooki-cho, Fukuyama, Hiroshima 721-0956 JAPAN

E-mail: k.sakamoto@manac-inc.co.jp

s.inoue@manac-inc.co.jp

* 3-1 Kazusakoito, Kimitsu, Chiba 292-1149 JAPAN

E-mail: s.nanba@manac-inc.co.jp

Abstract

In the previous meeting held at Xian (2008) novel phosphorus-containing polyimides were presented. This article describes recently developed new types of the phosphorus-containing polyimides thermal properties and its flame retardancy. These novel phosphorus-containing polyimides were prepared by using newly synthesized dianhydrides (patents in press). The glass-transition temperature(Tg) of these phosphorus-containing polyimides was depends on the diamine used in the preparation (223 ~ 258 °C). TMA analysis of the phosphorus-containing polyimides showed the typical phosphorus-containing compounds aspect, it means the shrinkage at high temperature. This means the phosphorus-containing moieties are incorporated in the backbone. Flame retardant qualitative test was also checked based on the UL 94 measurement.

Introduction

Among the various phosphorus-containing aromatic compounds, phosphorus-containing aromatic diamines are mainly used in epoxy resins for thermal stability and flame retardancy. These phosphorus-containing polymers are mainly used in the fields of electronics and electrical application and transportation because of its cost performance. In the polyimides fields few phosphorus-containing polyimides are used because of the price. As well known, polyimides are flame retardant materials, but getting thin film, for example less 10 μ m the polyimide film reduces its flame retardancy. So we applied novel phosphorus-containing anhydrides to polyimide thin film. The two type of novel phosphorus-containing acid dianhydrides were prepared and applied to the polymerization with various diamines

At present, the quantitative flame retardant data, such as UL94 rating, LOI and char yields is being under measurement. In the coming conference we will present more data concerning flame retardant. The data of phosphorus-containing polyimides are shown below.

難波悟* 坂本勝洋 井上進介 マナック株式会社・かずさ研究所* 研究開発部

Examples of phosphorus-containing polyimides properties

The thermal analyses of the typical phosphorus-containing polyimide film are shown below also TMA are illustrated.

#	1	2	3
Acid anhydride	Type I	Type II	Type II
Diamine	BAPP	4-ODA	BAPB ^{*3)}
Tg °C	244	258	223
P content ^{*1)} %	3.4	4.4	3.4
Flame retardancy ^{*2)}	○	○	○

※ 1) theoretical data

※ 2) test method was based on UL94

※ 3) 4,4'-Bis(4-aminophenoxy)-biphenyl

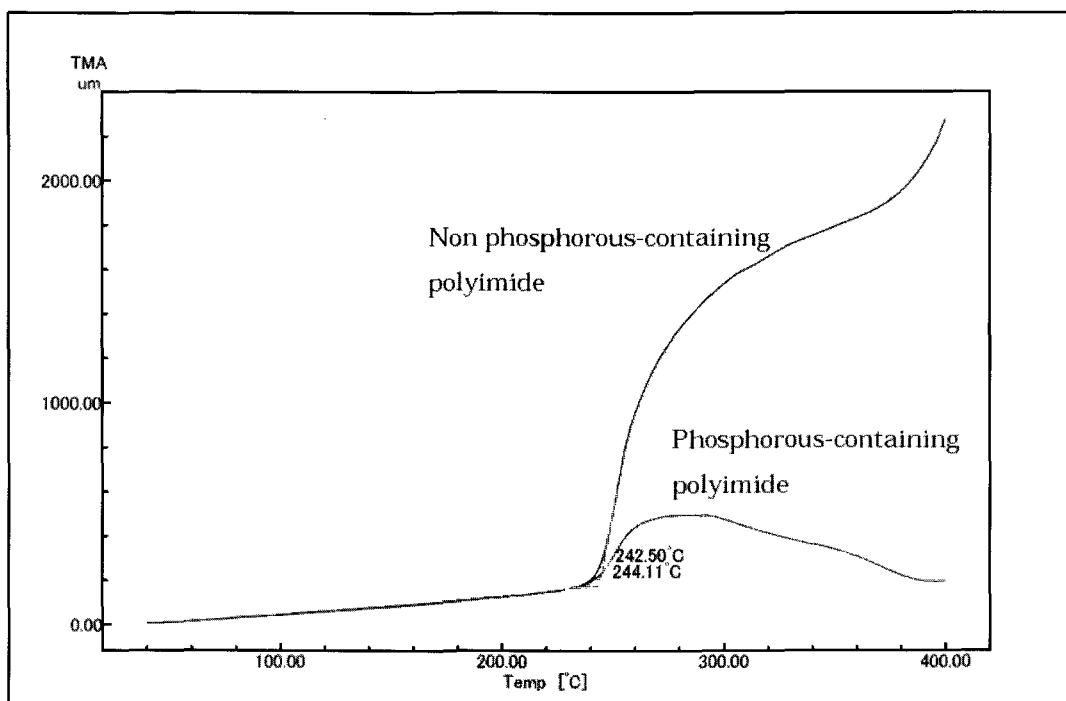


Fig 1 TMA analysis (in air) of phosphorus-containing polyimide film I compared with non-phosphorous polyimide

Reference : 1) J.Polym.Sci:part A vol40, 369-378 (2002)