

New High Heat Resistant White Molding Compound for LED

Hayato Kotani Takayuki Akimoto Tatsuya Matsuno Tomohiro Hayashi

Advanced Performance Materials Operation Headquarters,
Advanced Integrated materials Business Sector,
Encapsulation Materials R&D Department

1 Abstract

In the spreading LED market in future, it is assumed that LED packages will be used at higher temperatures due to the output design and external circumstances, whereupon the structural materials will require higher heat resistance against discoloration than current situation. The discoloration of structural materials by heat causes to decrease optical intensity of LED output.

To meet these requirements from market requirements, we developed an epoxy resin by introducing a functional group capable of suppressing the discoloration due to heat. Moreover, we finally obtained a new product of high heat-resistant white molding compound materials for LED in combination with a highly reflective filler.

2 Key Features

- High heat-resistant white molding material with excellent transfer-molding processability.

3 Development Background

The LED (Light-Emitting Diode) is a device used to convert electricity to light energy. Various package structures have been developed for various applications, and in recent years, the 0.5-watt input power class surface mount LED packages have become increasingly popular; mainly for backlight liquid crystal displays and other generic illuminations. Its development trend to date has been to focus on achieving higher efficiency, i.e. packages with higher luminous flux, miniaturization, those allowing higher electric currents to pass through¹⁾, and manufacturing LED packages operable under high-temperature environments with an extended service life. Accordingly, we developed and started selling white molding material for white LED reflectors²⁾.

However, as LEDs penetrate the market more and more, LED packages will predictably have to withstand even higher temperatures, based on the power output design and operating environment. With this in mind, the structural materials used for their packages should be LED packages subject to even more stringent requirements to operate within a high-temperature environment. Heat resistance means resistance to discoloration and degradation and heat-related discoloration of component parts reduces the light output power emitted by LED packages. To start this product development, we reviewed the molecular design of base resin and developed a new high heat-resistant resin for LEDs, utilizing the key features of epoxy resin to meet these performance requirements for the markets.

4 Product Design

4.1 Application package

This product is a material related to the surface mount LED package, the latter of which comprises the components shown in Figure 1. These include metals such as lead frames playing the role of electrode and substrate, reflectors as insulation material between electrodes and reflecting light emitted by devices, and a protective device in transparent resin and containing dispersed fluorescent particles to convert wavelength. The developed material applies to reflector material.

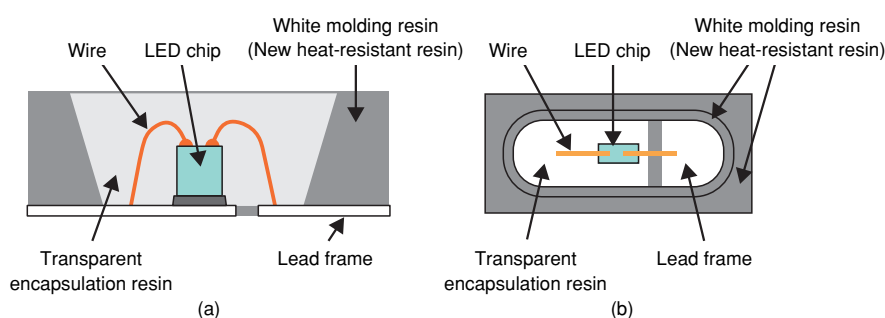


Figure 1 LED package design a) Cross-section b) Top view

4.2 Basic Design

Our basic product design centers on composite material; comprising our unique epoxy resin, which is compatible with transfer-molding and package-assembling processes as well as meeting the required performances in terms of optical properties and reliability³⁾ for LED packages, and highly reflective fillers. A functional group capable of suppressing thermal discoloration was also introduced into the epoxy resin to boost its heat resistance. Thermal discolorations of reflector material are basically caused by heat treatment steps during the processes of assembling LED packages, soldering components by reflow onto a substrate, and heating emitted by LED devices in operation. We confirmed our product could effectively suppress thermal discoloration. Figure 2 shows the reflow- and heat-resistance performances respectively.

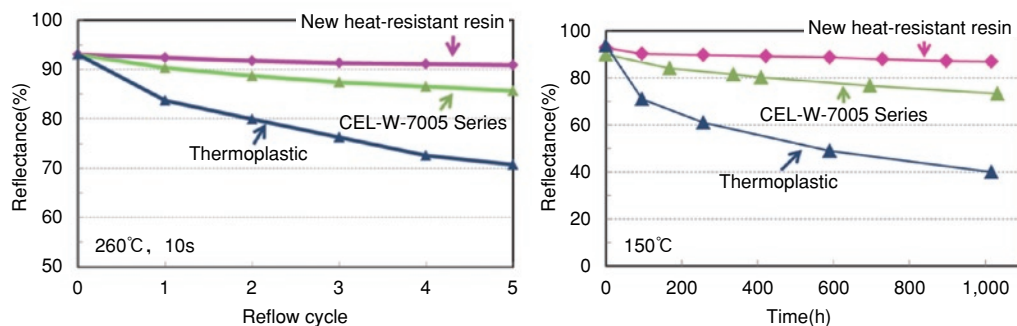


Figure 2 Properties of the newly developed white molding material a) Reflow Resistance, b) Heat Resistance

5 Future Business Development

- Sales promotion of newly developed materials
- Take actions in response to enlarged substrate
- Expand product applications

【References】

- 1) Yukihiro Demukai, Development of LED-Package for Lighting Applications, TOYODA GOSEI TECHNICAL REVIEW, Vol. 53, pp. 22-29 (2011).
- 2) Hitachi Chemical Co. Ltd., News Release, Expanded Applications of “White Epoxy Molding Resin” for LED-Package (October 13, 2011).
- 3) Naoyuki Urasaki, White reflection molding compound for LEDs of surface-mounted devices, Hitachi Chemical. Technical Report, Vol. 50 pp. 7-10 (2008).