APPLICATION**NOTE**

Determination of the Thermal Diffusivity of a Thin Polymer Film by Conventional LFA Analysis

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1 LFA 467 *HyperFlash*®

Introduction

Polyimide films are used in flexible printed circuits, satellites and superconductor facilities, and also as an insulating coating material due to its superior resistance to heat, low temperature and radiation.

In recent years, the demand for an ability to determine the thermal diffusivity of highly conductive thin films has steadily increased due to the miniaturization of electronic devices. However, when testing thin films with the laser/light flash analyzer (LFA), a rear temperature excursion move is generated within an extremely short time period. In these cases, conventional flash analyzers fail in determining the thermal diffusivity due to the long pulse width and low data acquisition rate.

By mean sof the LFA 467 *HyperFlash*® (figure 1), the evaluation of the thermal diffusivity and thermal conductivity of thin films can be evaluated due to the shorter pulse width (20 µs) and high data acquisition rate (2 MHz) of the detector. The system allows variation of the pulse duration between 10 µs und 1200 µs by means of a micro-controller.

The data acquisition rate applies to both the IR detector and the pulse mapping channels (two independent channels). Fast scanning of the pulse becomes possible with a frequency of 2 MHz and therefore, a multitude of points for the pulse shape can be recorded.

Measurement Conditions

- Sample holder size: ☐ 10 mm
- Sample thickness: 12.5 µm
- Pulse voltage: 200 V
- Pulse width: 10 µs
- Detector: MCT
- Temperature: 25°C

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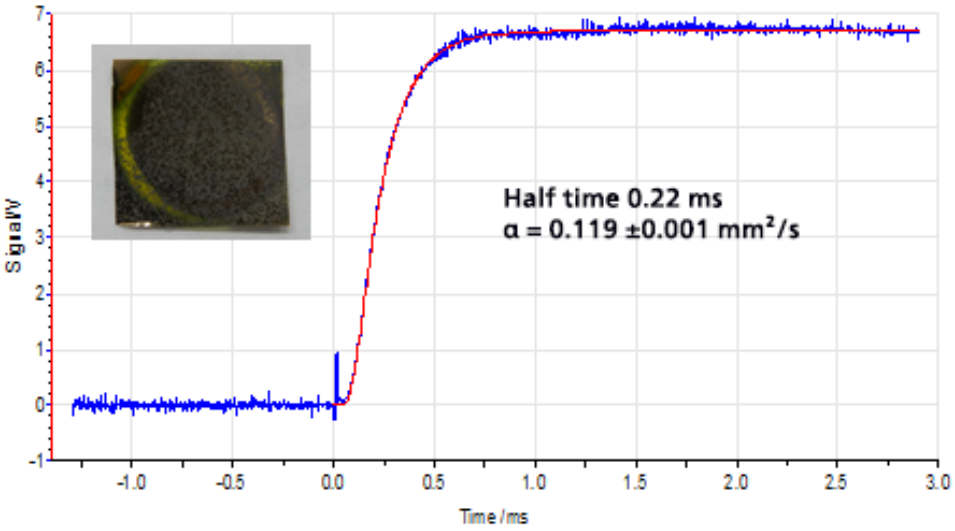

2 Polyimide film (12.5 µm thick) measured with the LFA 467 *HyperFlash*® at room temperature

Measurement Results

Figure 2 shows a measurement on a gold-coated polyimide film (APICAL NPI, KANEKA Corporation) with a thickness of 12.5 µm at room temperature using a pulse width of 10 µs. The detector signal ('thermal curve', blue) and fitting curve ('theoretical curve', red) are in very good agreement. The small pulse width is indicated by the short spike in the thermal curve. The thermal diffusivity amounts to 0.119 mm^2/s ±0.001 mm^2/s and is in accordance with literature data.

Conclusion

This example does an excellent job of demonstrating the measurement capability of the LFA 467 *HyperFlash*® for thin films within the thickness range of some µm. The high data acquisition rate and small pulse width allow for precise monitoring of the thermal curve, which can usually not be accomplished by conventional LFA systems.

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