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Application News

Differential Scanning Calorimeter DSC-60 Plus
Fourier Transform Infrared Spectrophotometer IRTracer™-100

Evaluation of PC/ABS Plastics with Different Blend Ratios

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User Benefits

- With DSC, it is easy to measure the glass transition temperature required to mold amorphous plastics.
- The glass transition temperature can be estimated from the PC blend ratio.
- The composition ratio after molding PC/ABS plastic can be confirmed.

■ Introduction

PC/ABS plastics combine the respective advantages of polycarbonate (PC) and ABS. It is shock resistant, heat resistant, and workable, and is used for automotive interior components and office machines. In addition, it is an excellent insulation material, so it is widely used for electronic parts. With amorphous plastics such as PC/ABS plastics, thermal properties such as the linear expansion coefficient, specific heat, and thermal conductivity have an inflection point at the glass transition temperature. In addition, with injection molding, it is important to assess the glass transition temperature as a guide to the solidification temperature. Firstly, samples were molded with PC plastic and ABS plastic blend ratios varying from 0 % to 100 % at 25 % intervals. A differential scanning calorimeter was used to measures the glass transition temperature, so that the relationship between the sample blend ratio and the glass transition temperature could be evaluated. Next, the conformity between the blend ratio before molding and the composition ratio after molding was evaluated using a Fourier transform infrared spectrophotometer. This article introduces an example of the evaluation and comparison of samples using these two instruments.

■ Measurement Samples

The blend ratios of PC/ABS plastics used in the measurements are shown in Table 1, and photos of samples No. (1), (3), and (5) are shown in Fig. 1.

Table 1 List of Measurement Samples

Sample No.	PC/ABS Blend Ratio
(1)	PC 100 %, ABS 0 %
(2)	PC 75 %, ABS 25 %
(3)	PC 50 %, ABS 50 %
(4)	PC 25 %, ABS 75 %
(5)	PC 0 %, ABS 100 %

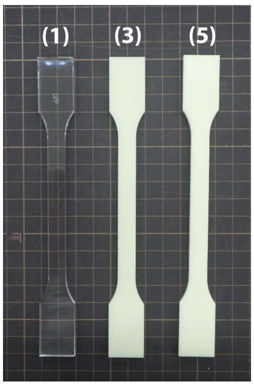

Fig. 1 Appearance of Samples

■ Sampling and Measurement Conditions

The samples were cut up finely, and placed in an aluminum crimp cell as shown in Fig. 2. Measurements were performed by the DSC-60 Plus shown in Fig. 3 using the measurement conditions shown in Table 2.

Fig. 2 Sampling

Table 2 Measurement Conditions

Differential Scanning Calorimeter:	DSC-60 Plus
Electric Cooler:	TAC-60i
Heating Rate:	20 °C/min
Temperature Range:	0 to 200 °C
Sample Weight:	8 mg
Atmosphere:	Nitrogen

Fig. 3 DSC-60 Plus

■ Measurement Results for PC/ABS Plastics

The measurement results from the DSC-60 Plus differential scanning calorimeter are shown in Fig. 4. With the PC/ABS plastic, Tg1, the glass transition temperature for ABS plastic, and Tg2, the glass transition temperature for PC plastic, were detected. Both Tg1 and Tg2 changed depending on the blend ratio. The relationship between the PC blend ratio and glass transition temperature is shown in Fig. 5. The relationship was essentially linear with respect to the blend ratio for both Tg1 and Tg2. In this way, the glass transition temperature for PC plastic could be estimated from the blend ratio. It is considered that this will enable investigation of the appropriate temperature for molding, as well as assessment of the inflection points for the thermal expansion coefficient and specific heat, thermal characteristics of the molded products.

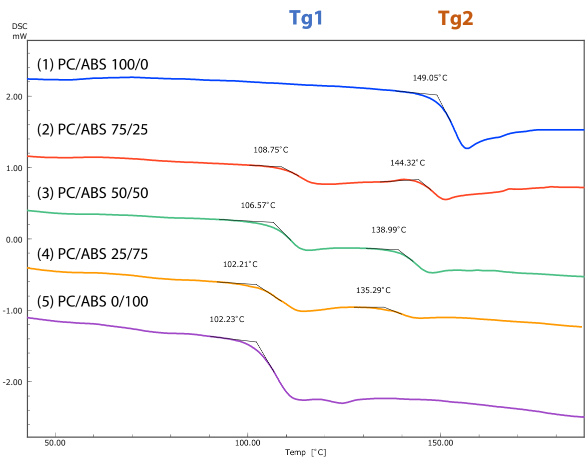

Fig. 4 DSC Curves for Sample No. (1) to (5)

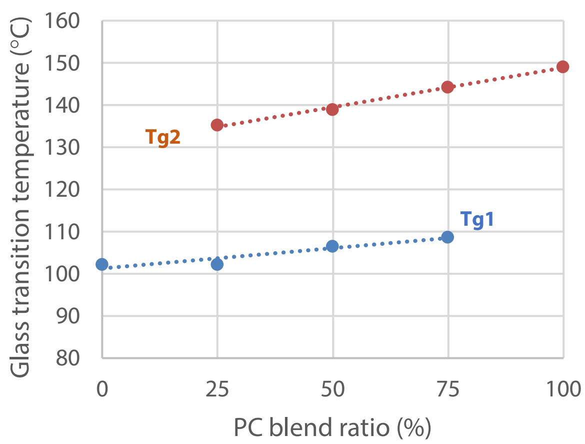

Fig. 5 Relationship between the PC Blend Ratio and the Glass Transition Temperature

Next, for injection molding, since the blend ratio of materials injected into the molding machine does not necessarily match the composition ratio after molding, measurements were performed using the IRTracer™-100 to check the composition ratio after molding. Enlargements of the IR spectra in the vicinity of 1770 cm^{-1} for PC/ABS plastics with different blend ratios are shown in Fig. 6.

IRTracer is a trademark of Shimadzu Corporation in Japan and other countries.

It was confirmed that as the PC blend ratio increased, there was an increase in the peak intensity due to C=O stretching vibration in the vicinity of 1770 cm^{-1}. It is known that the peak intensity is proportional to the PC blend ratio in the material. The relationship between the PC blend ratio and the peak intensity is shown in Fig. 7. A linear graph was obtained, so it could be confirmed that for the various samples after molding, the PC plastic and ABS plastic were molded with the correct composition ratio at 25 % intervals.

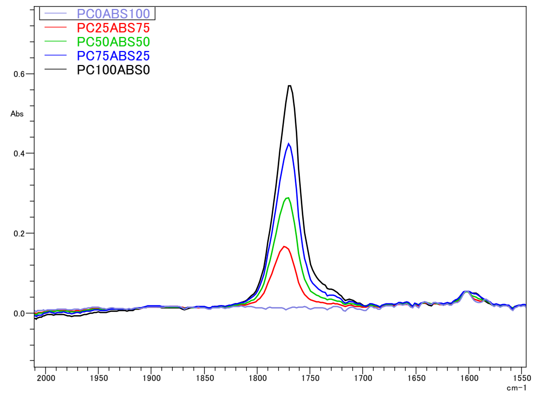

Fig. 6 Enlargements of the IR Spectra in the Vicinity of 1770 cm^{-1}

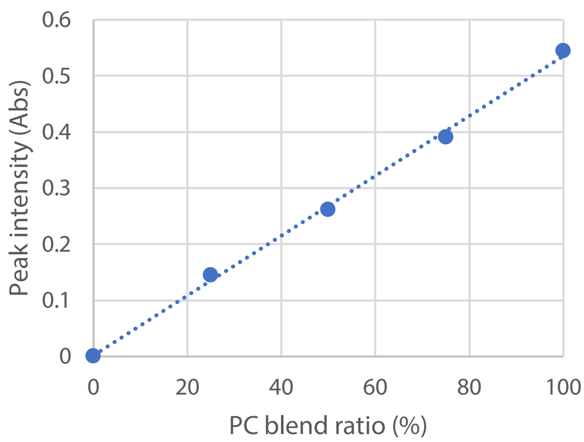

Fig. 7 Relationship between the PC Blend Ratio and Peak Intensity

■ Conclusion

Molded PC/ABS plastics with different PC/ABS blend ratios were evaluated using a differential scanning calorimeter and a Fourier transform infrared spectrophotometer. The relationship between the PC blend ratio and the glass transition temperature was assessed, and the composition ratio after molding was confirmed.

01-00260-EN First Edition: Oct. 2021

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