Application Brief

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Measurements of the Blending Ratio of Blended Yarn Using Highway TA

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1. Introduction

Blended yarn of cotton and polyester are widely used as material for dress shirts and other clothes. The blending ratio of cotton and polyester is required for labeling and is usually acquired by analysis of the cellulose weight using a wet process. However, wet process measurement requires over two hours for a single analysis and uses various chemicals so there is demand for an alternative method.

Meanwhile, attempts have been made to acquire the blend ratio from differences in the decomposition temperatures of cotton and polyester from TG measurements. However, the decomposition temperatures of cotton and polyester are similar under general measurement conditions. Therefore, it is difficult to acquire accurate values, even when the blend ratio can be roughly estimated.

In this brief, Highway TA [1, 2] is used to convert the TG measurement results of a fiber blend of cotton and polyester to low heating rate data to acquire the blend ratio.

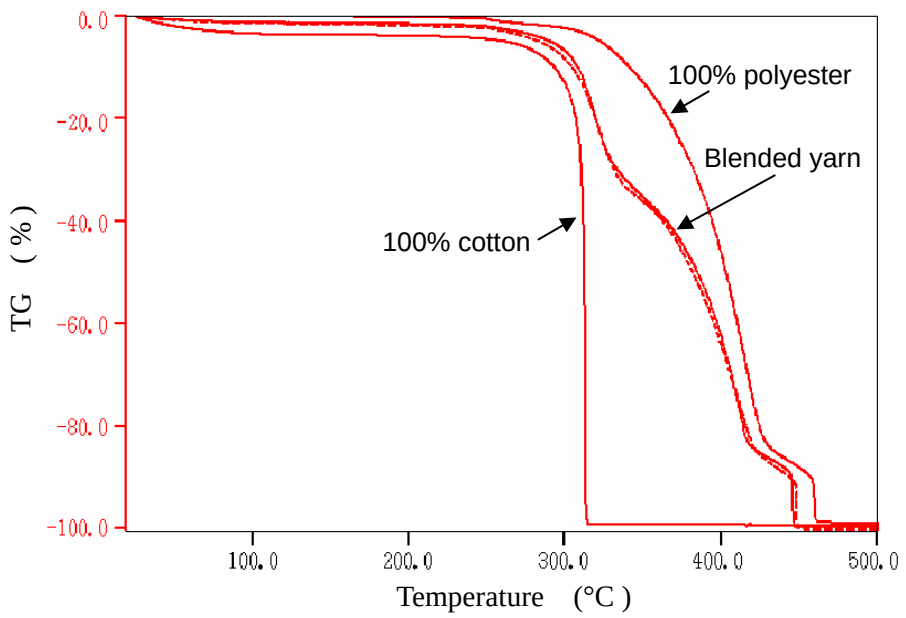

Figure 1 TG measurement results for the 100% cotton, 100% polyester, blended yarn A and B
Heating Rate : 10°C/ min
– – – – – – – – : Blended yarn A (E/C 67.3/32.7)
———————— : Blended yarn B (E/C 65.1/34.9)

2. Experiment

The measurement samples were as follows: 100% cotton, 100% polyester, and two different cotton/polyester blends (labeled yarn A and B). According to wet process analysis results, the cotton proportion for the blends A and B were 32.7% and 34.9%, respectively.

A TG/DTA6200 Thermo Gravimetry Differential Thermal Analyzer was connected to an EXSTAR6000 PC station. For the measurements, a 5mg sample was heated at 10°C/min in air.

3. Result

The TG measurement results for the blended yarns are shown in Figure 1. A two stage weight decrease was observed for both Samples A and B between 300 and 400°C, bordering at around 330°C. The first weight decrease up to around 330°C was due to the decomposition of cotton and the second weight decrease was due to polyester. The ratio of these weight decreases can determine the cotton/polyester ratio of the blended yarns. However, it is difficult to accurately read the weight decrease ratios from the results in Figure 1 and clarify the difference since the blend ratios differ by only 2%.

Highway TA was used to convert the A and B measurement results of Figure 1 to data of a heating rate of 0.1°C/min. Figure 2 shows the results. The two-stage weight decrease was completely separated for both samples. The first-stage weight decrease rates, which equates to the thermal decomposition of cotton, for samples A and B were 32.3% and 35.6% respectively. These results clearly define the difference between samples A and B and roughly match the results from the wet process method, which shows that Highway TA can effectively measure such blend ratios.

While it would require over 3 days to actually measure at a heating rate of 0.1°C/min to 500°C, Highway TA can perform low-heating measurement simulations in a short amount of time.

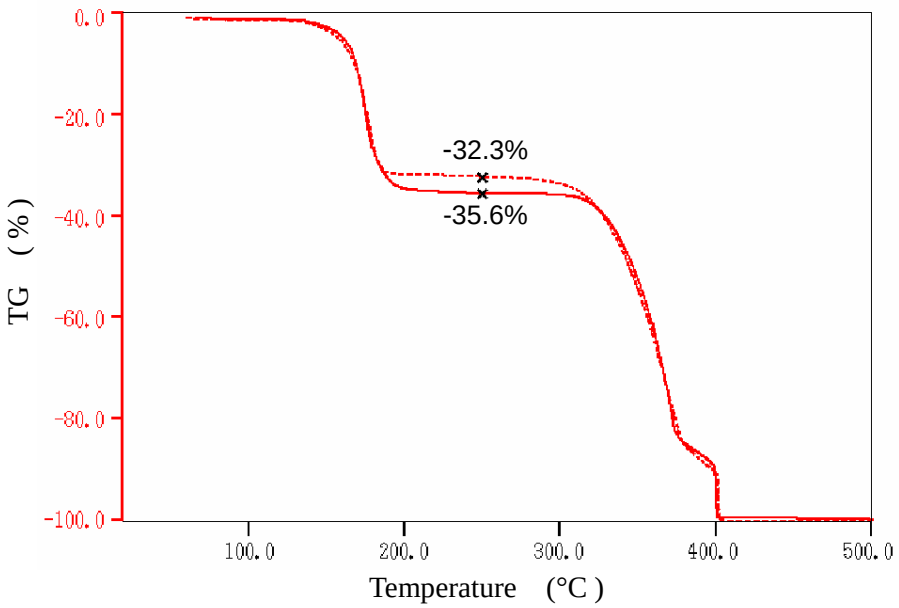

Figure 2 Results of the conversion of TG measurement results for Samples A and B to 0.1°C/min data by Highway TA
Heating Rate : Converted from 10°C to 0.1°C/min
– – – – – – – – : Blended yarn A
———— : Blended yarn B

4. Summary

Highway TA can clearly distinguish cotton/polyester blend rates of down to difference of 2 %.

The heating rate conversion function of Highway TA can clearly separate multiple weight decreases that occur in the same temperature region. It is expected to be applied to various fields.

Reference

1) R. Kinoshita, R. Nakatani, Y. Ichimura and N. Nakamura, The 34th Japanese Conference on Calorimetry and Thermal Analysis, p42 (1998)
2) Application Brief TA No.71, SII NanoTechnology (2000)