SHIMADZU
Excellence in Science

AGX™-V Precision Universal Testing Machine

Application News

Tensile Test of Resin Materials with Different Compounding Ratios

F. Yano

User Benefits

- JIS K7161 (ISO 527-1) compliant testing is possible by using the AGX-V precision universal testing machine and TRViewX non-contact digital video extensometer.
- The approximate compounding ratio of PC/ABS resins can be confirmed by conducting a tensile test.

■ Introduction

PC/ABS resin is an engineering thermoplastic that adds the molding workability and plating characteristics of acrylonitrile butadiene styrene (ABS) resin to the heat resistance, impact resistance, and flame-retardant property of polycarbonate (PC). It is widely used in automotive interior parts, office equipment, and household electrical appliances due to its excellent impact resistance, weathering resistance, and moldability. Since the mechanical properties of PC/ABS change depending on the compounding ratio, an understanding of its mechanical properties at various compounding ratios is important for developing materials in line with the required specifications.

This article introduces an example of a tensile test of 5 types of PC/ABS test pieces with different compounding ratios using the Shimadzu AGX-V precision universal testing machine.

■ Measurement System

The tensile test was carried out with a TRViewX non-contact extensometer mounted on the AGX-V precision universal testing machine. Fig. 1 shows the condition of the test, and Table 1 shows the device configuration. The test was conducted in compliance with JIS K7161, "Plastics-Determination of Tensile Properties-" (ISO 527-1). The initial test speed was 1 mm/min, and was switched to 50 mm/min at 0.3 % displacement. Tables 2 and 3 show the details of the test conditions and the test piece information, respectively, and Table 4 shows the information concerning the compounding ratios.

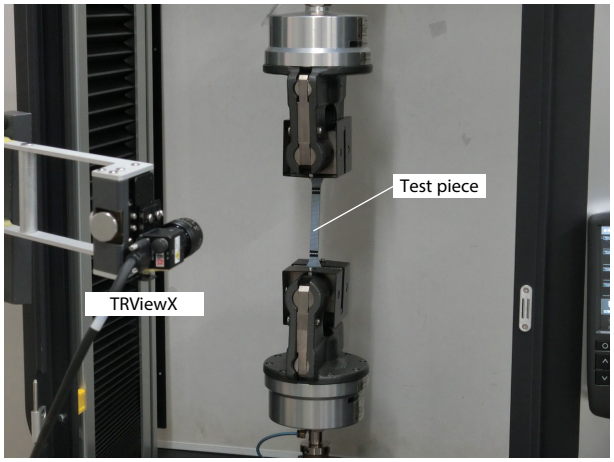

Fig. 1 Condition of Test

Table 1 Device Configuration

Testing machine	: AGX-V
Load cell	: 5 kN
Grips	: Pneumatic flat grip
Extensometer	: TRViewX240S
Software	: TRAPEZIUM™X-V

Table 2 Test Conditions

Test speed	: 1 mm/min 50 mm/min (switched at 0.3 % displacement)
Gauge length	: 75 mm
Number of tests	: n = 5

Table 3 Test Piece Information

Width	: 10 mm
Thickness	: 4 mm
Gripping distance	: 115 mm

Table 4 Compounding Ratios of Test Pieces

Specimen No.	PC/ABS resin compounding 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 %

■ Test Results

Fig. 2 shows an example of the stress-strain curves of the PC/ABS resins. The properties clearly differ depending on the compounding ratio of PC. Fig. 3 shows the relationship between the compounding ratio of PC and the tensile strength, elastic modulus (tensile modulus), and tensile strain at break (percentage elongation after fracture) of the resin. From Fig. 3, it can be understood that tensile strength increases as the compounding ratio of PC becomes higher. A similar tendency can also be seen in tensile strain at break, although the variations are large. On the other hand, the elastic modulus showed its highest values when the ratio of PC was 50 to 75 %.

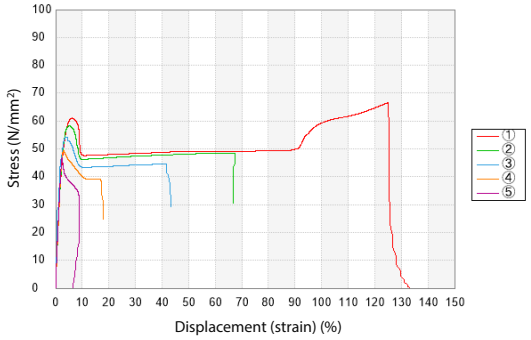

Fig. 2 Stress-Strain Curves

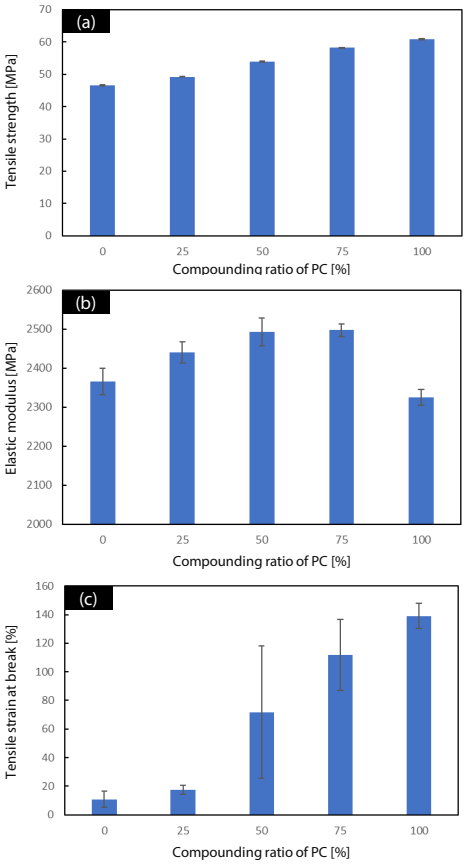

Fig. 3 Relationship of PC Compounding Ratio and Various Physical Property Values
(a) Tensile Strength, (b) Elastic Modulus, (c) Tensile Strain at Break
Note: Error bars show standard deviation.

Again, when tensile strength was plotted against the compounding ratio of PC, a roughly linear approximation was possible, suggesting that the compounding ratio can be predicted from tensile strength.

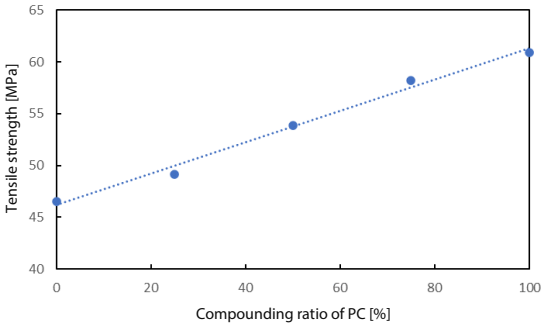

Fig. 4 Tensile Strength Plotted Against Compounding Ratio of PC

■ Conclusion

A tensile test of PC/ABS resin samples conforming to JIS K7161 was carried out, and it was found that the physical properties of the resins vary depending on the compounding ratio. In particular, because the relationship between tensile strength and the compounding ratio of PC was substantially linear, it was suggested that the compounding ratio can be predicted from tensile strength. The AGX-V and TRViewX are useful tools for understanding the mechanical properties of resin materials and confirming their compounding ratios.

01-00439-EN First Edition: Jan. 2023

SHIMADZU
Shimadzu Corporation
www.shimadzu.com/an/