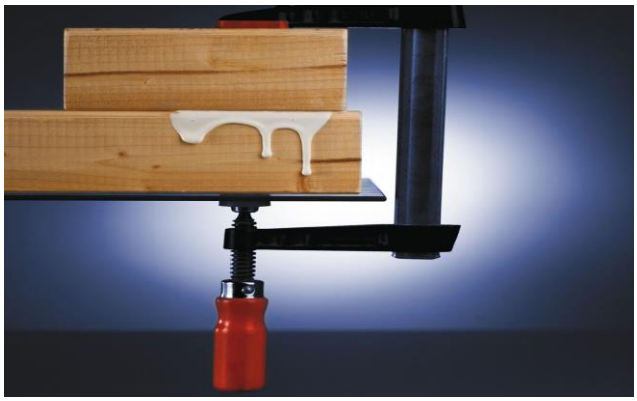
Quality Control of Adhesives

How can viscosity testing of adhesives improve adhesive bonded joints? This application report shows typical measurements for production and processing of adhesives with Anton Paar's rotational viscometer ViscoQC™ 100.



1 Introduction

Viscosity is one of the most important parameters in production and processing of adhesives. Further incoming material must be viscosity tested before using it (e.g. in a dosing system).

For low-viscosity adhesives, viscosity is important for penetrating the gluing surfaces and for flowing into the gluing gap. For high-viscosity adhesives the correct viscosity is required to bridge larger gaps and to prevent it from flowing into small gaps and pores on the surface.

Adhesives can be single component, but they often consist of two components, the resin and the hardener. This example shows a polyurethane based resin and an isocyanate hardener.

Both components separately and the mixed product need to be viscosity tested. For this report, the resin's viscosity is measured.

1.1 Keywords

Adhesives, glues, two-components adhesive, viscometer, rotational viscometer, viscometer adhesives, viscosity, dynamic viscosity, viscometer quality control, ISO 2555

2 Experiment

Instrument: ViscoQC™ 100 - H

Spindle: RH3

Speed: 20 rpm, 30 rpm, 40 rpm (According to the standard, the tests needs to be done within a range of 45 % to 95 % torque)

Temperature: 25 °C

Sample: Resin, 25 to 30 Pa·s at 20 °C.

All measurements were performed with ViscoQC™ 100 - H viscometer from Anton Paar GmbH according to ISO 2555.

2.1 Test Procedure

The most common test for viscosity measurement is performed at a constant temperature, while increasing the speed on the sample. With this test, the sample's viscosity under different speeds can be determined. At low speeds the sample's viscosity in rest is measured (e.g. when stored in its can or cartouche), at higher speeds the sample's viscosity in movement (e.g. when squeezing a tube or processing using a dosing system) is tested.

2.2 Test Conditions

- The sample was tested in its original container. The size and amount of the container corresponds to a 600 mL beaker.
- The sample was slowly mixed with a spatula for 5 minutes to homogenize. To achieve temperature stabilization, the sample then rested for 60 minutes before starting the measurement.
- The viscometer speed was first set to 20 rpm.
- The dynamic viscosity reading was taken after 30 seconds. Between two measurements, the sample rested for another 30 seconds. ViscoQC™ 100 serves direct reading of the dynamic viscosity in Pa.s as a single point value at the end of a measurement.
- The speed was increased step-wise (20 rpm, 30 rpm, 40 rpm).

- The measurement was stopped in between changing the speeds to automatically create a data point in V-Collect Software.
- After viscosity measurment at the maximum speed, the speed was decreased in steps to the slowest speed.

3 Results and Discussion

The results are shown in Figure 1. It shows the change of dynamic viscosity (red curve) and torque % (green points) over speed rate.

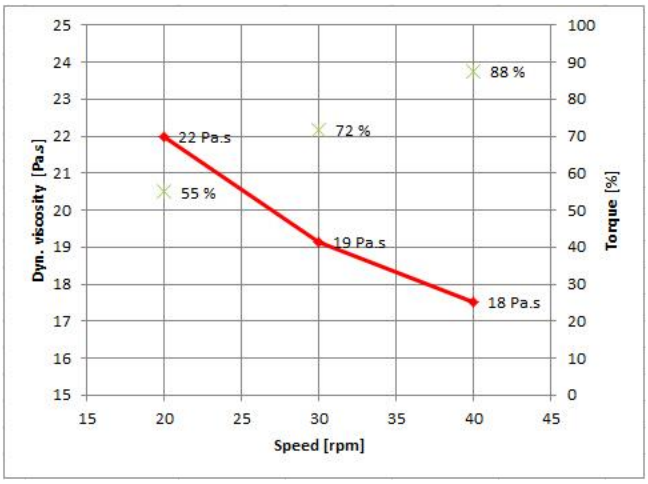


Figure 1: Viscosity of resin at certain speeds

4 Summary

The viscosity of the resin decreases by increasing the speed. This type of flow behavior is referred to as “shear thinning”. It is a common behavior of such a substance. The viscosity of a resin at a certain speed serves information about its quality.

5 Accessories

For this application several accessories for the ViscoQC™ 100 were used:

Pt100 sensor: For monitoring the temperature

V-Collect Software: Connect ViscoQC™ to a PC with USB interface and export the measurement results directly to the data collection software V-Collect.

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