Quality control of coatings and paints

Analyzing the viscosity of paints at different speeds shows you how the paint behaves during e.g. painting the wall. This application report can offer you a brief insight on typical measurements with the rotational viscometer ViscoQC™ 100.

1 Introduction

A rotational viscometer like the ViscoQC™ 100 is commonly used for quality control of coatings and paints. The viscosity ("thickness") of the paint specifies whether the paint can be applied with a brush, a roller, a sprayer, or other methods. Furthermore, paint needs to be applied uniformly to the surface without uneven ridges. Quick single point viscosity checks at one or at different speeds to study the shear thinning behavior of paints and coatings are possible with ViscoQC™ 100. Shear thinning means that the viscosity decreases by increasing the speed.

1.1 Keywords

Paint, coating, chemical industry, rotational viscometer, viscometer, viscosity, viscosity quality control, dynamic viscosity, ASTM D2196

2 Experiment

Instrument: ViscoQC™ 100 - R
Spindle: RH5
Guard: R
Speeds: 2 rpm, 20 rpm, 40 rpm
Temperature: 23 °C
Sample: Synthetic dispersion paint

All measurements were performed with ViscoQC™ 100 - R rotational viscometer from Anton Paar GmbH *according to ASTM D2196-10*. ViscoQC™ 100 - R is suited for a viscosity range of 10 to 40 000 000 mPa·s.

ASTM D2196-10 is a standard test method for the investigation of the rheological properties of non-Newtonian materials such as paints and coatings by a rotational (spindle-type) viscometer.

2.1 Test Procedure

- 500 ml of the sample was filled in a 600 ml beaker.
- After vigorously stirring for 10 min. the sample stands undisturbed for 60 min.
- The viscometer was set at the rotational speed of 2 rpm (translates to 25 torque%).
- The dynamic viscosity reading (in mPa·s) was taken after ten revolutions (after 5 minutes) by stopping the measurement.
- The speed was increased step-wise (20 rpm, 40 rpm) and viscosity measurement started again. The dynamic viscosity reading was taken after ten revolutions of the spindle.
- After viscosity determination at the maximum speed, the speed was decreased in steps to the slowest speed.

3 Results and Discussion

Dynamic viscosity at a low rotational speed divided by the viscosity at a speed ten times higher gives you the viscosity ratio (shear thinning index). This ratio is an index of the degree of shear thinning over that range of rotational speed. Higher ratios indicate a greater shear thinning effect.

$$Shear\ thinning\ Index = \frac{viscosity\ (at\ a\ low\ rotational\ speed)}{viscosty\ (at\ a\ speed\ ten\ times\ higher)}$$

The shear thinning index of the paint was calculated as following:

$$Shear\ thinning\ Index = \frac{49467\ mPa \cdot s\ (2\ rpm)}{9820\ mPa \cdot s\ (20\ rpm)} = \mathbf{5}$$

The shear thinning behavior of the paint is additionally shown in Figure 1.

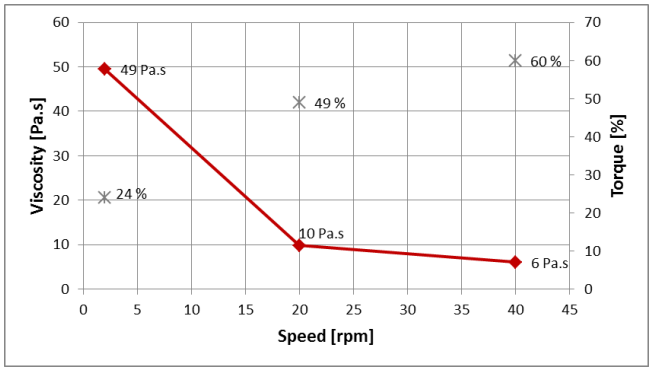

Figure 1: Viscosity of paint at certain speeds

4 Summary

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

5 Accessories

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

Pt100 sensor: For monitoring the temperature.

Flexible cup holder: To exactly center the sample container (600 mL beaker, pint, ½ pint or quart). A different position of the sample vessel is a big risk for erroneous measuring results.

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

Contact Anton Paar GmbH
Tel: +43 316 257-0
application@anton-paar.com | www.anton-paar.com