Viscosity measurement

In the laboratory course on viscosity measurements, four experiments are carried out. First, the density of a test fluid is determined with a pycnometer. Then, the viscosity of the test fluid is measured at three stations with different devices. If possible, bring a stopwatch.

1 Couette viscosimeter

Function A cyliner is immersed in a cylindrically shaped container. The inner cylinder rotates. Therefore, in the gap between the inner and the outer cylinder a Taylor-Couette flow is created. From the measurement of the angular momentum for the fixed angular velocity the viscosity can be calculated. The dials of the supplied apparatus show the resulting dynamic viscosity.

Operation The apparatus is fixed in horizontal position with a lab stand. The apparatus can be precisely orientated by using a round air level. The outer container is attached with a bajonet catch to the underside of the apparatus. The shaft of the apparatus is locked and the inner cylinder can be screwed to the shaft. The thread is left-handed! After unlocking the shaft, the dynamic viscosity can be read from one out of the three dials. The three differently sized inner cylinders each correspond to a different dial. Numbers on the cylinders and on the dials indicate which cylinder corresponds to which dial.

2 Cannon-Fenske routine viscosimeter

See the operation instructions in the appendix.

Hagenbach Correction In a fully developed, laminar pipe flow there is a linear relationship between the pressure gradient and the volumetric flow rate of the fluid. This linear relationship corresponds to a linear relation between the viscosity of the fluid and the duration of the flow through the pipe. However, in a capillary of finite length the inflow causes a small additional, inertia-dominated pressue drop. This additional pressure drop is accounted for by the Hagenbach correction, which is, expressed as correction seconds, listed in a table in the operation manual.

3 Falling Ball Viscometer (Höppler)

See the operation manual in the appendix.

Sphere constants:
sphere no. 2 (20. 3. 2007): $K = 0,0526\ \mathrm{mPa\,s\,cm^3/g}$.
sphere no. 3 (13. 10. 2005): $K = 0,0835\ \mathrm{mPa\,s\,cm^3/g}$.