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A NEW SETUP FOR VISCOSITY MEASUREMENTS OF FLUIDS AS A FUNCTION OF SHEAR RATE AND PRESSURE

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A capillary tube is implemented between two pumps to measure viscosity for different volume flow rates und different back pressure levels. This setup creates conditions more similar to industry than measurements with other rheometers. A speed controlled pump which regulates volume flow and a flow indicator with screw drive principle for exact control are used to pump the fluid through the test tube. At the outflow a torque controlled pump is used as a hydraulic brake. Three pressure sensors are portioned along the test tube to measure pressure drop. With this setup back pressure levels to 150 bar and various volume flow rates can be realized and measured with a high resolution of 1 kHz. The volume flow limit depends on the fluid. In the experiments volume flow rates between 50 and 150 cm³/s and back pressure levels between 15 and 110 bar were chosen to simulate industrial conditions. Three different tubes with a diameter of 4, 4.5 and 5.5 mm and a length of 800 mm were used. Two silicon oils with viscosity 1 and 10 Pa·s served as test fluids. The oils were also measured in a couette rheometer with shear rates up to 4000 s⁻¹ to compare it with results measured with the new setup, where shear rates up to 15000 s⁻¹ were reached. All measurements were taken at room temperature. The viscosity shows a small pressure dependency that is already noticed in areas between 15 and 110 bar. Towards higher shear rates the oils are highly pseudoplastic. The major conclusion is that results from the new setup coincide very well with results obtained by other types of measurements and known datasheets. The advantages of this setup are that volume flow rates and pressure levels can be controlled exactly and changed rapidly and that test conditions are close to industrial conditions.