MOL-42166 Rheology

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The formulary is enclosed, other literature is forbidden. Calculators are permitted.

Answer to all questions

1. **Short questions**

   a) Does the temperature have a stronger impact on the viscosity of polycarbonate or polyethylene? Why?

   b) What is thixotrophy, and what can cause it? Name two applications where thixotrophy is important.

   c) What is the major limitation of melt index device and Brookfield viscosimeter compared to capillary and rotational rheometers? How you can get a bit more information than usually about rheological behaviour of the measured fluids also with these devices?

2. **Essay.** Draw a typical shear viscosity curve for a polymer melt. Explain what happens to the polymer chains at different regions of the curve. Comparison of viscosity curves can give a lot of qualitative information about the polymeric material. Explain how the following properties affect on the shape and location of the viscosity curve: molecular weight, molecular weight distribution and chain branching.

3. **Essay.** What different things affect on the viscosity of a suspension and how?
4. Calculation. The figure below shows the pressure drop $\Delta p$ as function of the $L/D$-ratio ($L =$ length of the capillary, $D =$ diameter) at apparent shear rates of 50, 200, 500 and 2000 $1/s$. This is the so-called Bagley plot. The diameter of the capillaries is 1mm. Determine the true shear stresses and use these and apparent shear rates to calculate the apparent viscosities. Read the information you need from the figure. Fit a power law model on the appropriate part of the viscosity curve. What are the values of the power law parameters?