



Aalto University  
School of Chemical  
Technology

KE-100.3410 Polymer properties

Exam 13.1.2012

1.

- a) What is the difference between homogeneous and heterogeneous nucleation in crystallization?
- b) Draw viscosity-shear rate picture for a typical pseudo plastic polymer and a Newtonian fluid

2. How could you determine whether a polymer sample consisted any ceramic filler? Explain which methods you would use, what is the principle of the measurement, what information you can obtain and why did you choose the method?

3. Draw a typical flow curve (modulus-temperature) for an amorphous polymer and mark in the figure how the curve differs if the sample is partly crystalline or cross-linked. Explain what the different regions in the figure are.

4. Viscosity of atactic polystyrene was measured in dilute solutions and the results are presented in table 1. Determine the viscosity average molecular weight for the sample  $\bar{M}_v$ . Mark-Houwink constants are  $k = 0.00848 \text{ ml/g}$  and  $a = 0.748$ .

Table 1. Efflux times for polystyrene samples. Solvent toluene,  $T = 25^\circ\text{C}$ .

Polystyrene concentration [mg/ml]	efflux time [t/s]
0	110.0
5.0	123.5
10.0	138.0
15.0	153.6
20.0	170.2
25.0	187.9

5. Viscosity of an amorphous PVC was measured to be  $3.9 \times 10^5 \text{ Pa}\cdot\text{s}$  at temperature  $122^\circ\text{C}$ . For processing, the viscosity should be below  $2 \times 10^4 \text{ Pa}\cdot\text{s}$ , but at least  $5000 \text{ Pa}\cdot\text{s}$ . At what temperature range should the processing be done?