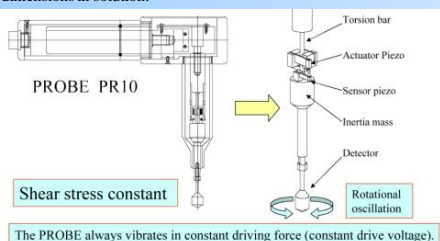


Intrinsic viscosity and Mark-Houwink coefficients of polystyrene/toluene solutions measured with the Viscomate VM-10A

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The viscosity of polymer solutions depends on the concentration and dimension of the macromolecules dissolved and consequently on the molecular weight and the specific interaction between the polymer and the solvent at hand.
As a consequence a measure of the viscosity of a polymer solution bears information useful to determine its molecular weight because it is not only a function of the concentration but also of the random coil dimensions in solution.



The VM-10A lab viscometer is a tensional, oscillation type viscometer driven by piezoelectric ceramics. This patented technology measures product viscosity via an angular-acceleration sensor.
Once the detector, actuated by piezo-electric ceramic, is immersed into the fluid, amplitude of the detector gets a decrease subject to viscosity from that when it is in the air (without the fluid).
This change of amplitude is detected by Angular-acceleration sensor, and calibrated to viscosity.

Some basic definitions

The intrinsic viscosity $[\eta]$ is the limiting value for low concentration values of the ratio between the specific viscosity and the concentration.

$$[\eta] \equiv \lim_{c \rightarrow 0} \frac{\eta_{sp}}{C}$$

The specific viscosity η_{sp} is defined by the following equation, where η and η_0 are the solution and solvent viscosities respectively.

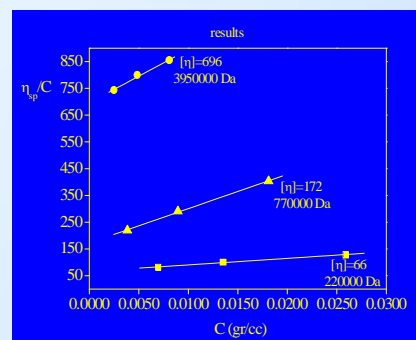
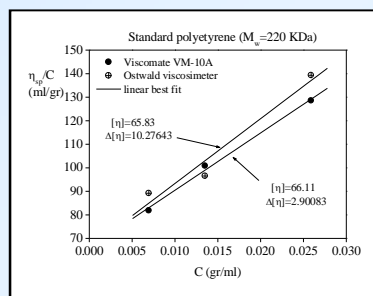
$$\eta_{sp} = \frac{\eta - \eta_0}{\eta_0}$$

Materials

Standard M_w	M_w/M_n
220000	1.03
770000	1.04
3950000	1.06

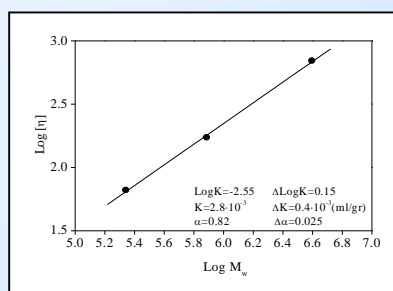
The measurements were performed using solutions prepared with three polystyrene monodisperse standards supplied by LabService dissolved in different concentrations in toluene supplied by RPE (Carlo Erba).

Results and discussion



The intrinsic viscosity has been measured also using a classical viscometer (Ubbelohde). The results agreed with those found using the Viscomate VM-10A within 1%.

Standard M_w	$[\eta]$ (ml/gr)
220000	66.1
770000	172.2
3950000	696.2



Mark-Houwink constants:
 $K = 2.8 \cdot 10^{-3} \pm 4 \cdot 10^{-4}$ (ml/gr)
 $\alpha = 0.82 \pm 0.025$.

Conclusions:

- Some solutions of monodisperse standard polystyrene in toluene have been prepared as a reference system.
- Using the intrinsic viscosity value measured for each solution the Mark-Houwink coefficients K and α were determined for this polymer solvent pair.
- The values of these constants measured with the Viscomate VM-10A were found in excellent agreement with those reported in the literature.