8 – times octo – dilatometer L75 / 120 LT

The Linseis dilatometer L75/120LT was developed to measure the expansion of polymer samples. Hereby up to 8 different samples can be measured simultaneously in a temperature range of –40°C up to +160°C. To cover the temperature range a commonly available climate chamber is used that incorporates a cooling generator and a heat source. The measuring sensors are mounted on top of the heat chamber and connect through a hole into the chamber. The complete arrangement is airtight, in order to avoid the intrusion of humidity into the measuring chamber.

It is possible to insert inert gas into the measuring chamber. The temperature measurement is done by means of 4 type K thermocouples which are hanging always between 2 samples.

This arrangement enables to get a good temperature profile over the measuring chamber.

The change of the length of the samples over the temperature change is measured with a LVDT sensor (linear variable differential transformer). This sensor has a very high resolution of 14nm (Nanometer) 10E-9. All 8 LVDTs are connected to the data acquisition / controller parts into the connected computer.

The normally used polymer samples can have a length of 80 up to 100mm. The cross-section of the samples can be 4 x 10mm up to 15 x 15mm.

8 – times octo – dilatometer L75 / 120 LT

As the used measuring systems are made out of quartz with an expansion coefficient of approx.
5 x 10E-7/K and is thus very small compared to the normal expansion coefficient of the polymer samples, the expansion of the measuring system can be neglected.

For very high accuracy measurements it is possible to use a calibration standard (none thermal expansion) to compensate the influence of quartz glass expansion. The maximum measuring range is +/- 1mm. To measure different sample length (80 up to 100mm) the piston of the measuring system can be adjusted by a motor.

For the zero adjustment the piston will be adjusted by a threat made of invar (invar has a very low temperature expansion at RT) that independent from sample length the core of a transducer (LVDT) is always in the center (zero adjustment).

For fast and easy change of samples all piston can be retracted by an excenter (operated by a motor).

Technical data

Linear measurement range	+/-1300um(+/-0,5%FS)	+/-1400(+/-1,0%FS)
	+/-1600um(+/-2,0%FS)	+/-1800(+/-10%FS)
reproducability	+/-0,5% Full-scale	
max. measurement error	+/-1% typical +/-0,5% Full-scale	
resolution	100 nm	
measuring principle	LVDT (differential transformer)	
zero adjustment (by a motor)	approx. 80 up to 100mm sample length	
load to sample (adjustable by a spring)	0 up to 500 mN	
output voltage amplifier	+/-1,0V Full-scale	
sample holder	quartz glass	
sample dimension	4 x 10 x 80 up to 100mm	
sample change	piston retraction by an excenter motor operated	
temperature range	-40°C up to +160°C	
power consumption amplifier	18VA maximum	
environment temperature	0 up to 40°C	

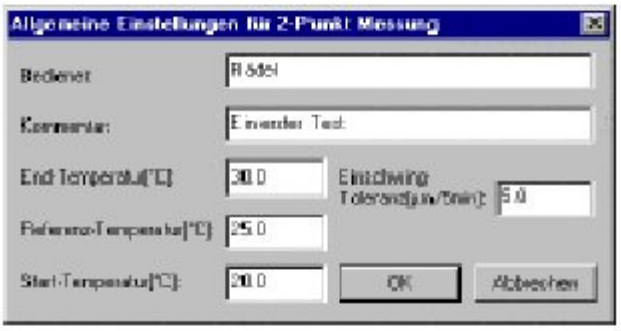
8 – times octo – dilatometer L75 / 120 LT

Software

With the measurement program “WIN-DIL 8S” it is possible to measure the thermal expansion of 8 samples parallel. For these two different measurement methods are available.

Two point measurement

The two point measurement method will calculate the average thermal expansion between 2 temperatures values. For this operation the start temperature of the system will be adjusted after the sample is inserted and the sample is stabilized. After this the system will be heated to the end temperature. From the temperature difference and the length change the CTE will be calculated.



Ak=expansion coefficient in (10E-4/K)
L0=length at room temperature in mm
Dl=length change in micrometer at temperature T
Dlref= length change in micrometer at temperature t ref
T= measurement temperature in °C
TREF= reference temperature in °C

At the two point measurement method a third temperature point is used.
That means the average thermal expansion for a low temperature range and for a high temperature range is calculated by a selectable reference temperature.
The result for each sample will be stored in an ASCII (text) file.

8 – times octo – dilatometer L75 / 120 LT

Contineous measurement

The continuos measurement method is using the following principle:
After start of the measurement the start temperature will be reached and for a stabilization will be waited. After this the system will be heated to the end temperature with a linear temperature ramp. During this the length change of the sample and the corresponding temperature will be measured once per second. The heating rate (K/min) and the sampling rage can be adjusted. The measurement values for each sample will be stored in a different binary file. This binary file is compatible to the Linseis standard dilatometer file format. This means all files can be loaded directly into the WIN-DIL Linseis evaluation software. The data can be also exported as ASCII files for example to use it with EXCEL.

File names and lot numbers

Each sample belongs to a lot number. These lot number will be also saved in the data file. Due to the reason 8 samples can be measured parallel, it is possible to combine samples with lots. As file name a combination of a 7 digit sample ID the separator “X” and the actual number of the measurement will be used.

During the two point measurement the extension “DIL” will be added. During the continuous measurement the extension “IPR” will be added.