Application Note TA5011

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TA5011 - The glass transition and softening for glass material

Introduction

TMA can measure the expansion ratio and softening temperature for materials.

In glass material, TMA is available to measure the expansion ratio change due to glass transition because the expansion ratio is different remarkably in the glass transition vicinity. And, it can be measured the material softening in the glass transition vicinity under the constant loading.

Instrument

TMA adopts the Rigaku's establishment reputation on differential expansion principle where the thermal expansion or shrinkage generated from the detection mechanism itself can be cancelled. It offers high accuracy and excellent reproducibility in expansion and shrinkage measurements, even with low expansion materials or thin materials.

Measurement and analysis

Figure 1 illustrates TMA measurement results of glass. As increasing temperature, the sample expanses and expansion ratio is increasing at around 290℃ due to glass transition. And then, the measurement sample can be observed the shrinkage due to softening at around 309℃.

Thus, it is possible to measure the glass transition temperature and softening temperature by employing TMA.

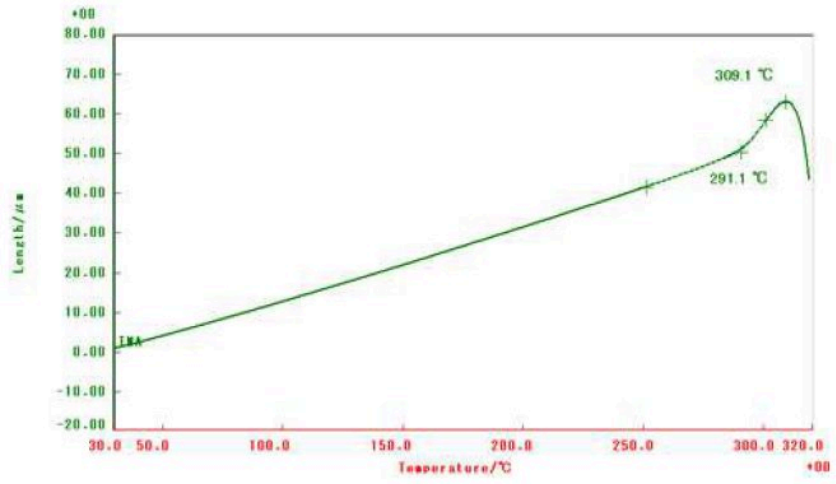

Figure 1: The glass transition and softening of glass

It is possible to calculate the measurement sample's expansion ratio and the mean expansion coefficient from the TMA measurement results. In this measurement sample, the mean expansion coefficient is 1.23×10^{-5} (1/K) at 250℃ when the base temperature is 30℃.

Temperature (°C)	Expansion (%)	CTE x10^{-5} (1/K)
50.0	0.021	1.06
100.0	0.079	1.13
150.0	0.140	1.17
200.0	0.204	1.20
250.0	0.270	1.23
300.0	0.378	1.40

Related products

TMA8311/HUM

TMA/HUM measures change in dimension or mechanical p roperty of a sample while subjected to a temperature regim e under water vapor atmosphere with a constant relative hu midity.