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Published: 01/01/2001

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Citation for published version (APA):
A Novel Dilatometer for the Investigation of $PVT$-$\dot{T}$-$\dot{\gamma}$ Behavior of Semi-Crystalline Polymers

M.H.E. van der Beek, G.W.M. Peters, H.E.H. Meijer
Eindhoven University of Technology, Department of Mechanical Engineering

Introduction
The heterogeneous microstructure of semi-crystalline poly-mers strongly depends on the thermal-mechanical history experienced during processing. For the prediction of material properties that are closely related to this microstructure, such as specific volume (figure 1), a realistic computational model is required. Therefore, a novel experimental set-up is developed that provides the input data for this model as a function of the thermal-mechanical history.

Methods
A dilatometer based on the principle of confined compression is designed to study the influence of the thermal-mechanical history on specific volume.

Design Considerations
A thermal-mechanical analysis performed with the finite element package MARC served as a basis for the detailed design of the dilatometer.

Conclusions
A dilatometer is designed to measure specific volume as a function of thermal-mechanical history that is characterized by:

- maximum applicable sample pressure $P = 10^3$ [bar]
- cooling rates can be reached to $\dot{T} = O(10^2)$ [K/s]
- uniform sample deformation with $\dot{\gamma} = O(10^3)$ [1/s]

References: