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A Novel Dilatometer for the Investigation of PVT-˙T-˙γ Behavior of Semi-Crystalline Polymers

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Introduction
The heterogeneous microstructure of semi-crystalline polymers 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: