How dense is your polymer?

Citation for published version (APA):

Document status and date:
Published: 01/01/2005

Document Version:
Publisher’s PDF, also known as Version of Record (includes final page, issue and volume numbers)

Please check the document version of this publication:
• A submitted manuscript is the version of the article upon submission and before peer-review. There can be important differences between the submitted version and the official published version of record. People interested in the research are advised to contact the author for the final version of the publication, or visit the DOI to the publisher’s website.
• The final author version and the galley proof are versions of the publication after peer review.
• The final published version features the final layout of the paper including the volume, issue and page numbers.

Link to publication

General rights
Copyright and moral rights for the publications made accessible in the public portal are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognise and abide by the legal requirements associated with these rights.

• Users may download and print one copy of any publication from the public portal for the purpose of private study or research.
• You may not further distribute the material or use it for any profit-making activity or commercial gain
• You may freely distribute the URL identifying the publication in the public portal.

If the publication is distributed under the terms of Article 25fa of the Dutch Copyright Act, indicated by the “Taverne” license above, please follow below link for the End User Agreement:
www.tue.nl/taverne

Take down policy
If you believe that this document breaches copyright please contact us at:
openaccess@tue.nl
providing details and we will investigate your claim.
How dense is your polymer?

R. Forstner, G.W.M. Peters, H.E.H. Meijer
Eindhoven University of Technology, Department of Materials Technology

Introduction
Specific volume of polymers is one of the main properties affecting the final dimensions and shape of products. A custom made dilatometer [1] with high cooling rates and shear rates was designed to investigate PVT behavior of polymers. The aim of this work was to develop a new frame and software control to create a table sized machine.

First try
A prototype dilatometer for rapid cooling [1] (100 °C/s), shear rates (80 s^{-1}) and elevated pressures (100 MPa) was developed. It consists of a pressure cell in combination with a tensile testing machine with rotation capability (Fig.1).

![Figure 1 The prototype (left). The experimental procedure (right)](image)

Tests were done on two iPP grades [2] (Fig.2). iPP-1: Mw = 365 kg/mol, Mw/Mn = 5.2; iPP-2: Mw = 500 kg/mol, Mw/Mn = 6.0. Experimental conditions: \( \dot{\gamma} = 38 \text{s}^{-1} \) during 3.0s, shear temperature= 153 °C, pressure= 40MPa, characteristic cooling rate= 1.4 °C/s.

![Figure 2 Effect of shear on specific volume. iPP-1 (left) and iPP-2 (right)][2].](image)

The next step
The new design represents a table sized machine (LxWxH=60x45x60cm) with additional control devices and computer facilities (Fig.3).

![Figure 3 New apparatus (left). Control sequence (right)](image)

Conclusions
A dilatometer for high cooling rates and shear flow with fully automated control was developed and built. The new features of the present design are: temperature controlled and isothermal measurements and no limitation in total shear.

References:

PO Box 513, 5600 MB Eindhoven, the Netherlands