

# Development of strain induced crystallisation modeling using the SCORIM process

**Citation for published version (APA):**

Zuidema, H., Peters, G. W. M., & Meijer, H. E. H. (1998). *Development of strain induced crystallisation modeling using the SCORIM process*. Poster session presented at Mate Poster Award 1998 : 3rd Annual Poster Contest.

**Document status and date:**

Published: 01/01/1998

**Document Version:**

Accepted manuscript including changes made at the peer-review stage

**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](http://www.tue.nl/taverne)

**Take down policy**

If you believe that this document breaches copyright please contact us at:

[openaccess@tue.nl](mailto:openaccess@tue.nl)

providing details and we will investigate your claim.

# Development of strain induced crystallisation modelling using the SCORIM process



H. Zuidema, G.W.M. Peters, H.E.H. Meijer

Eindhoven University of Technology,  
Faculty of Mechanical Engineering,  
Section Materials Technology,  
P.O. Box 513, NL 5600 MB Eindhoven



## Introduction

For semi-crystalline polymers different (flow induced oriented) crystalline structures cause anisotropy in the final product. Accurate prediction of the structure is essential to influence the product properties.

## Objective

- conformation of strain induced crystallisation (SIC) modelling by predicting layered structures.

## Theory

Dependent on the amount of strain experienced during processing, different crystalline structures will be present in the solidified polymer product (fig.1).

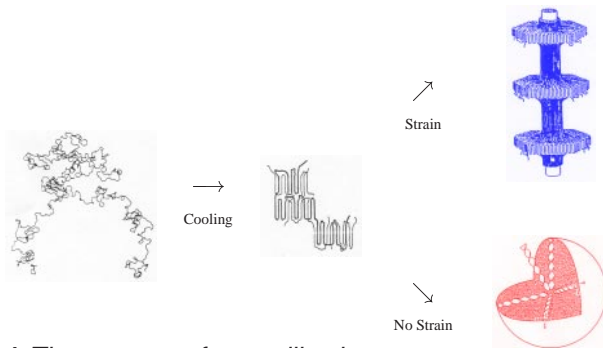


fig.1 The concept of crystallisation

While the SCORIM process (Shear Controlled Orientation Injection Moulding) is suited to create extreme situations of the injection moulding process, it is used as a test case for the modelling of crystallisation kinetics during injection moulding.

## SCORIM

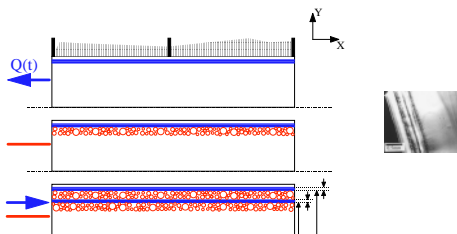


fig.2 A representation of the layered structure in the SCORIM process.

In the SCORIM process a flow is maintained in the mould after it has been filled, during solidification/crystallisation of the polymer. SIC is enhanced by flow and results in layers of different crystalline structures (fig.2). As the interesting part of the mould is the region where polymer is present that has not re-entered the runner system, the analysis is restricted to the central region. The procedure for a process is visualised by the pressure distribution (fig.3).

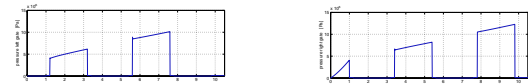


fig.3 The pressure at both sides of the flow domain.

Calculation of the strain is done using the Leonov model [1]. Due to the filling of the cavity the strain peak develops near the wall. After the flow is reversed, it decreases to zero and starts increasing again, although it is frozen in partly by the solidified layer, resulting in a layered structure (fig.4).

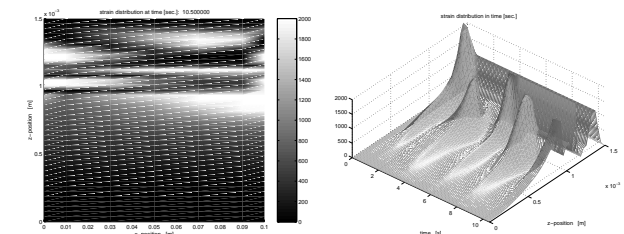


fig.4 The resulting distribution of the strain (left) and in time at  $x = 0.05$  [m] (right).

## Discussion

In most models used for the calculation of the flow-induced crystallisation kinetics the number of nuclei depends on the amount of strain/stress. For the SCORIM process this would mean that after reversal of the flow, all nuclei will disappear! This is not a realistic result.

## Conclusions

Another type of modelling will be used in the future, for instance, the number of nuclei dependent on the invariants of the strain.

## References:

- [1] ZUIDEMA ET. AL.: *Progress report and update on the contribution of the TUE to the Decrypto project.* (Intern. report, Eindhoven University of Technology, MT 98.015, 1998).