

# Preface

The growing demands on the reliability, safety and lifetime of machines, equipment and components made of polymers and composites make it necessary to develop meaningful test methods for the assessment of fracture properties. For this purpose, polymer-specific evaluation methods and concepts of the field of technical fracture mechanics and polymer diagnostics/polymer testing are used. Within polymer sciences, these areas of research have emerged as separate disciplines over recent years, evidenced by curricula of polymer engineering programmes at universities and universities of applied sciences.

The present status report on the current state of knowledge of technical fracture mechanics of polymers and composites with polymer matrix has been supplemented by revised presentations from the 14th discussion conference on “Deformation and Fracture Behaviour of Polymers” and by contributions describing our own research. By including additional contributions dealing with the investigation into the toughness of polymers with time-dependent fracture mechanical characteristics and the use of crack resistance concepts for polymers and elastomers, we aim to provide a comprehensive overview of the current state of knowledge.

The discussion conference on “Deformation and Fracture Behaviour of Polymers” has been taking place every two years in Merseburg for more than 30 years and has become a recognised scientific conference.

The 2014 conference was held jointly with the international scientific congress “PolyMerTec 2014”, which was organised by the Merseburg University of Applied Sciences and focused on engineering topics for the first time.

The conferences aim at showcasing the progress in fundamental research and applied research in this scientific discipline. This is accomplished by means of plenary talks, short contributions and lively discussions among the large number of expert colleagues.

Essential topics are as follows:

- Polymer testing, damage analysis and polymer diagnostics of components
- Toughness characterisation of polymers with fracture mechanics concept

- Hybrid methods for polymer testing and diagnostics
- Non-destructive polymer testing (ultrasound)
- Long-term static behaviour and ageing

The conference programme also includes exhibitions of equipment used for non-destructive and destructive material testing, polymer analytics and elastomer and film testing.

This book follows the status reports that have already been published by Springer:

- Deformation und Bruchverhalten von Kunststoffen  
Hrsg: W. Grellmann und S. Seidler  
1998, ISBN 3-540-63671-4
- Deformation and Fracture Behaviour of Polymers  
Eds.: W. Grellmann and S. Seidler  
2001, ISBN 3-540-41247-6

A comprehensive compilation of mechanical and fracture mechanical properties from the literature and own research is documented in the following encyclopaedia:

- Mechanical and Thermomechanical Properties of Polymers  
Group VIII Advanced Materials and Technologies Volume VIII/6A3  
Eds.: W. Grellmann and S. Seidler  
2014, ISBN 978-3-642-55165-9

In addition to the aforementioned books on the deformation and fracture behaviour of polymers, the Merseburg School edited the textbooks *Polymer Testing* for students at universities and universities of applied sciences. These textbooks were published by Hanser in German (2005, 2011, 2015) and English (2007, 2013). A Russian translation appeared in 2010.

These textbooks on polymer testing and diagnostics and on technical fracture mechanics of polymers and composites with polymer matrix also form the basis of an online encyclopaedia on “polymer testing and diagnostics”. This online encyclopaedia follows the wiki system known from Wikipedia and is available for free at <http://wiki.polymerservice-merseburg.de> in Version 4.0 (2014).

With the edition of this status report, we hope to contribute to an enhanced understanding of specific problems of the discipline among colleagues from different research institutes and the polymer industry.

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