Material concepts and modeling

The main focus of research in this field is the clarification of the connection between microscopic structure and macroscopic properties of flowable as well as networked, reinforced rubber systems. Main areas are:

- development of micro-mechanical material models for filler-reinforced elastomers using finite element calculations
- elastomer resistance and contact mechanics with rough surfaces
- filler and reinforcement
- dielectric properties of carbon black-filled systems
- dynamic high-frequency properties
- rheology of rubber compounds
- aging and wear resistance.

Simulation and continuum mechanics

Within this group we are concerned with main research in:

- problem oriented material models for e.g. elastomer, thermoplastics and vulcanizates (Mullins and Payne effect, material damping, anisotropy)
- implementation of new material concepts into Abaqus and MSC.Marc
- simulation of fatigue and aging phenomena
- parameter identification by means of inhomogeneous loading distributions
- simulation of self-organizing processes within the material.

The consolidated findings are used for efficient FE simulations and stress analyses of elastomer components.

Contact

Deutsches Institut für Kautschuktechnologie e.V.
Eupener Straße 33
D-30519 Hannover

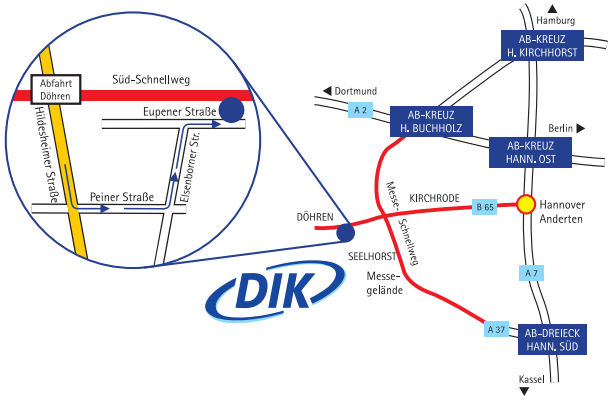
Phone: +49 (0) 511 84201-0
Telefax: +49 (0) 511 8386826

info@dikautschuk.de
www.dikautschuk.de

Contact persons

Prof. Dr. R. H. Schuster (Managing director)
Dr. U. Giese (Elastomer chemistry)
Dr. Th. Alshuth (Elastomer physics)
PD Dr. M. Klüppel (Material concepts)
Dr. H. Geisler (Materials development)
Prof. Dr. E. Haberstroh (Processing methodology)
Prof. Dr. J. Ihlemann (Simulation and continuum mechanics)

How to find DIK



Layout: www.kitazo.de

Taking the lead in innovation

Research at DIK

Deutsches Institut
für Kautschuktechnologie e.V.

Research at DIK

Innovative and successful applications along with high quality elastomeric materials require highly-qualified staff working on application-orientated research.

This is why research at DIK is focused on the characterization of raw materials and elastomers, the development of materials and processing methods, as well derivation and identification of material concepts as their implementation into appropriate simulation environments. To cover these fields, DIK has six specialist departments that work at a high scientific level, using an interdisciplinary approach, while focusing on issues of current interest.

Elastomer chemistry

Research in this department concentrates mainly on:

- characterization of multiphase systems (morphology)
- polymeric fillers
- polymer-filler-interactions
- vulcanization
- aging mechanisms
- modification of fillers and polymers
- nano materials (synthetic and natural origin)
- „Leachables" and „Extractables" from polymer materials
- emissions and environmental exposure of elastomers
- transport processes of gases and liquids in elastomers.

Extensive experience is the basis for dealing with environmental aspects such as recycling, emissions and the environmental exposure of elastomer products. For food and pharmaceutical suitability, methodological development is also an important field – for instance in the trace analysis for polymer materials.

Elastomer physics

Focal points here are the characterization, selective adjustment and prediction of the properties of elastomeric materials and components when subjected to operating conditions. This field includes:

- dynamic-mechanical properties up to high frequencies
- customized acoustic, damping and friction properties
- long-term prediction of relaxation and creep under acceleration
- prediction of the service life of components subjected to dynamic stress
- fracture mechanics and damage calculation
- magnetorheological elastomers for sensor technology and adaptronic.

DIK's activities in these areas make use of state-of-the-art equipment, including that which is designed in-house, such as dynamic crack development testing with optical monitoring of the deformation area.

Materials development

In materials development, the findings from other disciplines are applied to the characterization of raw materials, compounds and elastomers as well as to processing. New materials with specific property profiles can be developed using numerous physical testing techniques. The focuses of research are:

- surface modification by plasma polymerisation and plasma activation at atmospheric pressure
- filler-distribution in rubber compounds
- evaluation of new raw materials.

Processing methodology

The final properties of rubber components are strongly dependent on the processing method. Research focuses on the analysis of conventional and novel manufacturing processes, e. g.:

- Investigation of the rheological properties and of processability
- discontinuous and continuous mixing processes
- compounding of dynamic vulcanized thermoplastic elastomers
- extrusion, calendering and injection moulding
- process optimization for industrial customers.

Process related research work is often done in cooperation with the material oriented departments.