

We offer you



German Plastics Center
Testing · Training · Research · Certification

Lifetime prediction Long-term and ageing behaviour of plastic parts

Services provided

- Support regarding the translation of component requirements (specification sheet) into material requirements
- Determination of material data for the long-term mechanical design
- Development of application and product orientated testing concepts for the evaluation of the long-term and ageing behaviour of plastic components
- Condition assessment of new plastic components or after long-time service
- Analytical investigations of ageing related property changes
- Implementation and further development of accelerated test concepts for fast predictions of the long-term and ageing behaviour of plastic parts (methods and models)
- Evaluation of the influence of processing conditions on the internal structure (morphology, weld lines, anisotropy, ...) and on the resulting component properties
- Development of simple testing concepts for quality monitoring of materials and components

Opportunities for cooperation

A cooperation with SKZ is possible in the form of either public funded projects or direct development orders. We gladly advise you on specific issues concerning funding opportunities or make you an individual, nonbinding offer.

For more information or for any questions please contact:

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Tel. +49 931 4104-147, bauteileigenschaften@skz.de

The address – when it comes to plastics.

As the largest plastics institute in Germany we offer practical solutions – tailored exactly to your requirements. For the past 55 years now we have seen ourselves as a partner to the plastics industry providing extensive system expertise: By means of **Testing and Quality Assurance** we support your product policy, supplying you with valuable arguments for your key markets. With more than 10,000 participants each year, we are the market leader for **Training and the Transfer of Knowledge** in the field of plastics. Our **Research** division bets on the development and improvement of production technologies in line with the market requirements. With the **Certification of Management Systems** we offer you the best prerequisite for efficiency and economic success.

Become part of a strong community!

With more than 390 members, the association for the promotion of the SKZ currently constitutes the most important and dynamic network in the field of plastics. Benefit from the numerous opportunities for cooperation achieved through the networking of experts from all areas of the plastics industry. Our network reflects the wide spectrum of the industry and offers excellent opportunities for the cooperation of economy, science and politics. For further information, please visit www.skz.de or contact us at fskz@skz.de

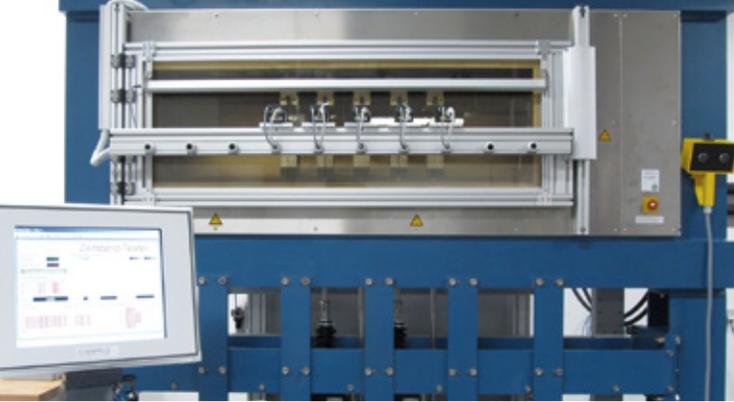
SKZ - KFE gGmbH | Research and Technology Transfer

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Research

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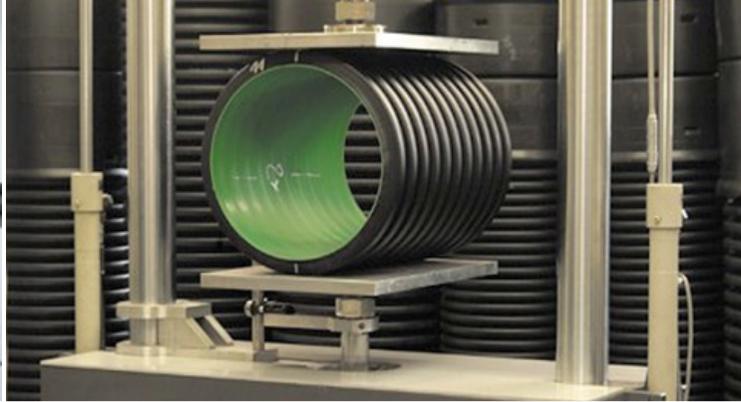
Apparatus for the accelerated testing of long-term creep behaviour

Lifetime prediction for plastic components

The success of plastic parts in a broad field of applications relies on the extraordinary advantages of plastics vs. conventional materials like metals, particularly with regard to weight savings, integration of functions and cost-effective processing technologies. For a sustainable success, the component properties need to meet the customer's expectations over the whole service life.

The minimum required service life of plastic components strongly depends on their application. It reaches from about 15 years for automotive components up to 100 years for plastic pipes and plastic sealing membranes. Furthermore, the demands on plastics steadily increase as they progressively replace metals in high-performance areas (e.g. high temperatures in engine compartment). Simultaneously the development timeframe continues to get shorter. Therefore, companies increasingly face a new problem: how to make reliable statements about the long-term and ageing behaviour of their products as fast and cost-effective as possible?

The **business unit Component Properties** within SKZ research defines itself as competent partner for all issues concerning **lifetime prediction and assessment of part properties for plastic components**.



Fatigue testing of a plastic component

Long-term mechanical behaviour

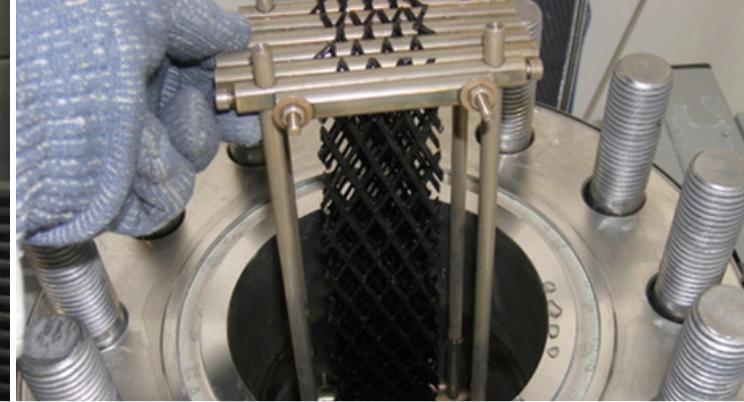
The long-term mechanical behaviour of plastics strongly depends on time, temperature and stress level due to its pronounced viscoelasticity. Common mechanical characteristics in material data sheets (e.g. yield stress, Young's modulus) are determined in quasistatic, short-term tests and are consequently only suitable for a pre-selection of materials. Long-term mechanical design requires parameter functions, which describe the mechanical behaviour as a function of the important factors time, temperature, load type and stress level.

Therefore, at SKZ we determine the long-term mechanical behaviour based on static and dynamic/cyclic tests. The resulting long-term data (creep, creep rupture and S-N curves) can be used for long-term mechanical design. The deformation and failure behaviour can be examined under various loading conditions (e.g. tension, pressure, bending) and over a wide range of temperatures. Besides conventional long-term tests, we focus on accelerated test methods to speed up the determination of the long-term mechanical behaviour. We continuously refine these methods in order to ensure the best compromise between speed and accuracy for long-term predictions.

Stress cracking resistance

Failure due to stress cracking (ESC = environmental stress cracking) is the most common failure reason for plastic components with about 25 % of all failures. Failure times can be significantly reduced by simultaneous impact of stresses (external or internal) and media that trigger stress cracking.

Besides the evaluation of stress cracking resistance using standard test methods, we develop accelerated test methods for lifetime predictions. Furthermore, we have different testing possibilities to qualitatively and quantitatively evaluate internal stresses in plastic components.



Thermo-oxidative ageing in a high pressure autoclave

Ageing behaviour

The ageing of plastic products can be caused by a multitude of factors such as heat, UV radiation and chemical agents. Ageing strongly depends on the service and environmental conditions of the product. Appropriate accelerated test methods are required for an accurate service lifetime prediction within acceptable times.

At SKZ we investigate the ageing behaviour of various plastic components under different conditions like temperature, chemical agents and weathering. Besides the prediction of ageing through accelerated testing, we focus on the development and application of suitable analytical techniques for the characterisation of the ageing state.

Structure-property-relationships

The properties of plastic components not only depend on the chemical/molecular structure, but also on the morphology and the internal stresses, that result from processing. The processing conditions can lead for example to different crystalline structures (degree of crystallinity, crystalline modifications), state of orientation (molecular and fibre orientation causing anisotropic properties), weld and flow lines, voids and impurities.

At SKZ we aim for a deep understanding of the correlations between structure and component properties in order to avoid negative effects or even gain better material properties.