Seminar im Rahmen des GRK 2078

Referee: **Dipl.-Ing. Frank Huberth**
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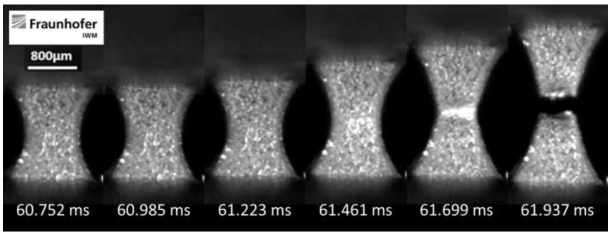
Date: Tuesday, December 18, 2018
Time: 14:00 h
Location: Bldg. 10.23, 3rd Floor, Room 308.1 (KM-Seminar Room)

Title: **Strain rate effects for crash and impact at macro and micro scales**

Abstract

Homogenous material characterization at different loading speeds, loading states and resulting strains and strain rates are well established especially in the range for crash applications with a maximum strain rate of 500 s-1 or in certain cases up to 1000 s-1. These high rates are realized by loading speeds of 10 m/s and more. For the strain analysis digital image correlation (DIC) is used based on high speed video frames of the sample surface or other optical methods. The force measurement is realized using load cells like the piezo based sensors, strain gages or user developed solutions. At Fraunhofer IWM a patented quasi local force measurement was developed. This device allows an improved force measurement compared to load cells in the load path. For tests at loading speeds higher than about 5 m/s the direct application of strain gages on the samples is obligatory for a reliable force measurement. As geometry independent reference value the nominal strain rate dεnom/dt is defined as the quotient of the initial loading speed v0 and the parallel length Lc. Smaller sample geometries with a shorter Lc lead to a higher nominal strain rate at the same loading velocity. This is one aspect for testing very small samples. Reducing geometry size is only useful until the sample is no longer representative for the material behavior and shows only local effects with large scatter in the results. This limit of application for this purpose is a continuous transition region for each material and local structure. For the investigation of local inhomogeneous material behavior it is essential to reduce the material volume to the volume of interest with the local effect inside. At lower loading speeds or small amplitudes this testing is done already at very small scales. For strain rate effects and failure at very small scales, currently only very few information exist. Results will be shown for different materials a dual phase steel HCT490X, a Polyolefin blend with local self-reinforcement and a long fiber reinforced thermoplastic (LFT).



Deformation states of a micro tensile test, filmed with 300.000 frames per second (© Fraunhofer IWM)

International Research Training Group (DFG GRK 2078)

Integrated Engineering of Continuous-Discontinuous Long Fiber Reinforced Polymer Structures

On the other side, the validation on a component level is needed under real loading conditions like crash or impact. These investigations show the performance and interaction of the single parts at well-defined boundary conditions. This is essential for the comparability of experimental and numerical results. On the macroscopic level, infrared imaging was developed as an additional tool for transient damage analysis. This will be shown at the results of a test series on CFRP.

Alle Interessenten sind herzlich eingeladen.

Prof. Dr.-Ing. Thomas Böhlke
(Sprecher des GRK 2078)