

## ABSTRACT

## Advanced Strain Field Analysis for Soft Polymers under Inhomogeneous Deformation

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Soft polymers, such as elastomers or hydrogels, exhibit complex mechanical behavior depending not only on the material structure and properties but also on the external loading, i.e. tension or compression, monotonic or cyclic, multiaxial deformation, etc. To better understand structureproperty relationships, systematic investigations using advanced experimental techniques are necessary. A key challenge is the precise estimation of strains, which may cover several decades (up to more than 1000 %) and deformation fields, that can be extremely inhomogeneous, e.g. in the region of crack tips or due to the necking of a sample [1].

In this contribution [2, 3], new approaches for strain field analysis specifically designed to address the following challenges will be presented: (i) easily applicable micro-particles for speckle patterns to analyze strain fields at high and in particular inhomogeneous deformation; (ii) sophisticated evaluation software for data analysis of optical and infrared images; (iii) (semi)-transparent materials or deformation-induced color changes of specimens; (iv) in situ measurements for comprehensive investigations. The results provide deeper insights into the underlying microstructural mechanisms behind the mechanical behavior and occurring failure modes of soft polymer materials. These data help to improve constitutive modeling significantly and pave the way to more accurate predictions of numerical simulations.

[1] T. Nakajima, T. Kurokawa, S. Ahmed, W. Wu, J.P. Gong, Soft Matter, 9, 1955 (2013).

[2] S. Wang, E. Euchler, S. Wiessner (manuscript in preparation).

[3] L. Zybell, E. Euchler, S. Wiessner (manuscript in preparation).