PREPARATION AND PROPERTIES OF CNT BASED ELASTOMER NANO-COMPOSITES

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An efficient strategy to improve simultaneously the electrical and mechanical properties in different elastomers has been put forward by the utilization of carbon nanotubes as filler. However, strong inter-tube Van der Waals forces often lead to aggregated structures, resulting in a higher percolation threshold of the nanotubes. Therefore, various techniques to disperse multiwalled carbon nanotubes (MWCNT) in elastomers have been tested in order to enhance the dispersibility and to ensure a better rubber-MWCNT compatibility. A significantly improved dispersion resulting in excellent mechanical properties can be achieved if ethanol as dispersion agent is employed. [1,2] A good dispersion can also be obtained by incorporating the CNT in silica filled rubber. [2,3] The resulting hybrid-materials show an enhanced mechanical stiffness and tensile strength, an increased modulus and a high electrical conductivity with quite low amounts of CNT. The improved mechanical properties are shown by stress-strain measurements. TEM investigations show the excellent distribution of nanotubes resulting in an pronounced CNT network.
Dynamic-mechanical and dielectric spectra have been analyzed to get more insight into the morphology and dynamics of these systems. Thereby, a better understanding of the conduction mechanism, the polymer-tube interaction and the filler networking in CNT nano-composites is achieved. The electrical percolation threshold in well dispersed elastomer systems amounts to about 0.6 vol.%. Additionally, the conduction mechanism was proven to take place over nanoscopic gaps between adjacent tubes. The analysis of the dielectric spectra allows the determination of these gaps. Hereby the gap size was decreasing with increasing CNT concentration which is analog to carbon black composites resulting in a minimum value of δ =3.5 nm.
Additionally, a series of ionic liquids has been tested in regard to an improved interaction between rubber and carbon nanotubes. [4] We found that in the presence of especially one ionic liquid, namely, 1-allyl-3-methyl imidazolium chloride, the physical properties are significantly improved due to a chemical coupling between carbon nanotubes and rubber chains.

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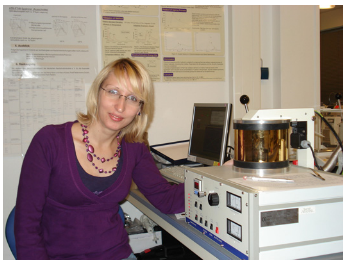

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- Dielektrische und dynamisch-mechanische Spektroskopie
- Ermüdungsverhalten von Elastomeren
- Herstellung und Charakterisierung von Nanomaterialien auf Basis von CNT und Schichtsilikaten
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