

## FUNCTIONALIZED SILICA PARTICLES AS MATRIX-REINFORCING FILLERS FOR POLYURETHANE ELASTOMERS

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Conventional polyurethane elastomers feature soft and hard segments. The soft segments are flexible long-chained diols, whereas the hard segments consist of parallel arranged diisocyanates connected by short-chained diols. Via hydrogen bonding of the urethane units, these parallel chains are linked and therefore quite solid. In combination, the two phases give the elastomer its flexibility and damping characteristics. By using different polyols or diisocyanates, a large variety of different polyurethane structures can be generated. Although applicable over a wide range due to the material's low glass transition temperature and the high temperature necessary for unclamping the hydrogen bonds, constant efforts target an extension of this range.

Concerning this approach, silica nanoparticles were introduced as reinforcing fillers into the material and should be bonded covalently to the polyurethane matrix. To achieve this interaction, the nanoparticles need to be surface-treated or surface-functionalized; silanes with an amino group were chosen for this purpose. To obtain a well-balanced polyurethane composite, stoichiometric calculations are necessary. We characterized both the size (SEM, DLS) and surface functionality (TGA, FTIR, titration, CHN analysis) of the silica nanoparticles to get information about the functionality and the number of functional groups per particle. Several material compositions with different amounts of silica nanoparticles were defined. Some effort had to be expended to ensure the intended size distribution of the nanoparticles, a homogenous distribution of the nanoparticles within the polymer matrix and the production of bubble-free polyurethane composites. Multiple specimens with different geometries were produced. One focus was the determination of mechanical parameters (DMA, rebound test, compression set) of the polyurethane composites, the second one was to display the structure of the composites' structure (REM, REM-EDX, AFM). The gained knowledge is the basis for creating and evaluating new compositions.