Modeling Wear of Elastomers with Intrinsic Self-healing for Reduced Particle Emission and Improved Lifetime Performance of Tires in Future e-Mobility Concepts

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The objectives of ModEl-FuturE are the creation of novel numerical tools for predictive wear simulations in combination with the elaboration of advanced experimental methods and the development of sustainable soft materials, namely tire rubber materials composed of particle reinforced elastomer networks including elastomers that show self-healing properties. Materials with self-healing effects have a reasonable expectation to increase the intrinsic strength against both crack initiation and propagation and, thus, improve the wear resistance.

Specifically, the numerical approaches for tire wear simulations developed in the project address damage and abrasion features using an energy-based criterion. To achieve this goal, special emphasis is given to utilize fracture-mechanical material properties. As a prerequisite to obtain these material properties capable for parameter identification, advanced experimental techniques for quantitative measurement of fracture-mechanical elastomer properties have been developed further. This allows for the evaluation of material-intrinsic tearing energies, which determine the extension limits of the dynamically loaded elastomer network in the rubber product, including materials with non-covalently bonded elastomer networks. A correlation between the fracture mechanical material property "intrinsic strength" and the wear rate in abrasive regime could be demonstrated and successfully employed for wear simulation.

The consortium partners from Saxony, Czech Republic and France combine expertise in numerical simulation, analytical model development, design of novel advanced test methods, and conceptuation of novel elastomer materials.

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