

Today LEDs can be found in a huge number of different applications. Accordingly there is a big diversity in design and application profiles. This in combination with issues that come from the competition on the LED market generates some demands, which are hard to meet at a time. A tool which is promising to be able to solve this problem is the Finite Element Method (FEM). The development of the required material models and their coupling is the aim of this work. Focus is set on the encapsulant of the LED. It enhances light output and protects sensible components (chip, wire-bonds). Today epoxy and silicone are the most often used encapsulant materials. Besides the "normal" thermo-mechanical behavior for both materials the most critical environmental conditions are investigated and translated into numerical models. The material properties of Epoxy make it a good candidate for outdoor applications. Accordingly its viscoelasticity, the curing behavior and the reaction on moisture is investigated. Moisture investigation includes diffusion behavior, water induced softening and swelling. Due to its properties silicone is mainly used in high power application with intensive blue light irradiation and elevated temperatures. Under such conditions silicone and related interfaces degrade and change their properties. The time and temperature dependent material degradation causes shrinkage, embrittlement and decreasing thermal expansion. The blue light reduces the adhesion between silicone and the housing material. The developed material models are finally used to simulate some typical encapsulant related failures. Simulation results and corresponding experimental data correlate to each other, which show the effectiveness of the developed material models and methods.