Thermal Simulations of a LED Light Using COMSOL Multiphysics

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Abstract

An experimental LED light composed of a multi-chip LED-module, a LED driver and an efficient heat sink, was investigated using COMSOL Multiphysics software and the Heat Transfer Module. In an LED light heat is mainly generated in the LEDs but some amount of heat is generated also in the LED driver. The main target of the simulations was to resolve the junction temperatures of LEDs, the most important information related to the light production and operational life time of the LEDs. The simulations provided temperatures in various parts of the LED light structure in steady-state conditions. An approximate thermal model was constructed based on the results. Time dependent simulations resolved the main time constant of the structure. Combining photometric measurements to the thermal measurements, luminous flux versus the junction temperature was resolved. The simulation results were validated using temperature measurements made with thermocouples and IR-imaging.