

Calculation Of The Lifetime Expectancy Of Battery Fuse

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Abstract

Fuses are crucial electrical safety devices that terminate circuits in case of overcurrent or short circuits. When used in e-mobility or solar power generation applications, they are exposed to extreme ambient temperatures and electrical loads that can cause mechanical failure due to thermal stress inside thin silver strips and their short lifetimes. ETI Elektroelement d.o.o. used COMSOL Multiphysics to calculate the lifetime expectancy of their product and optimize the design itself to achieve reliable operation in these conditions. A complex multiphysics model was created that coupled the AC/DC module, Heat transfer module, Solid mechanics module, and Fatigue module. Since fatigue testing can take years to finish, they accelerated the experiments to verify the numerical model, using derating factors both in the real world and in simulation.

Figures used in the abstract

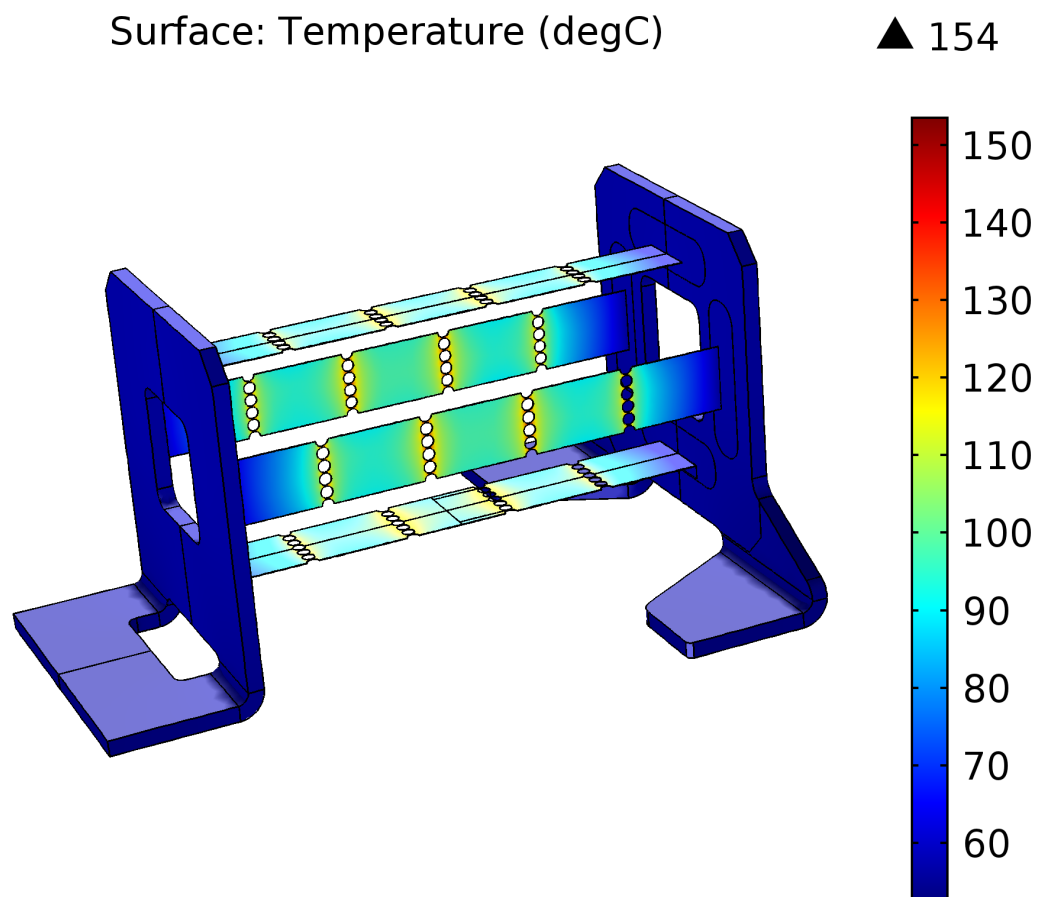


Figure 1 : Temperature field inside battery fuse.

Time=304 s Surface: von Mises stress, Gauss-point evaluation (MPa)

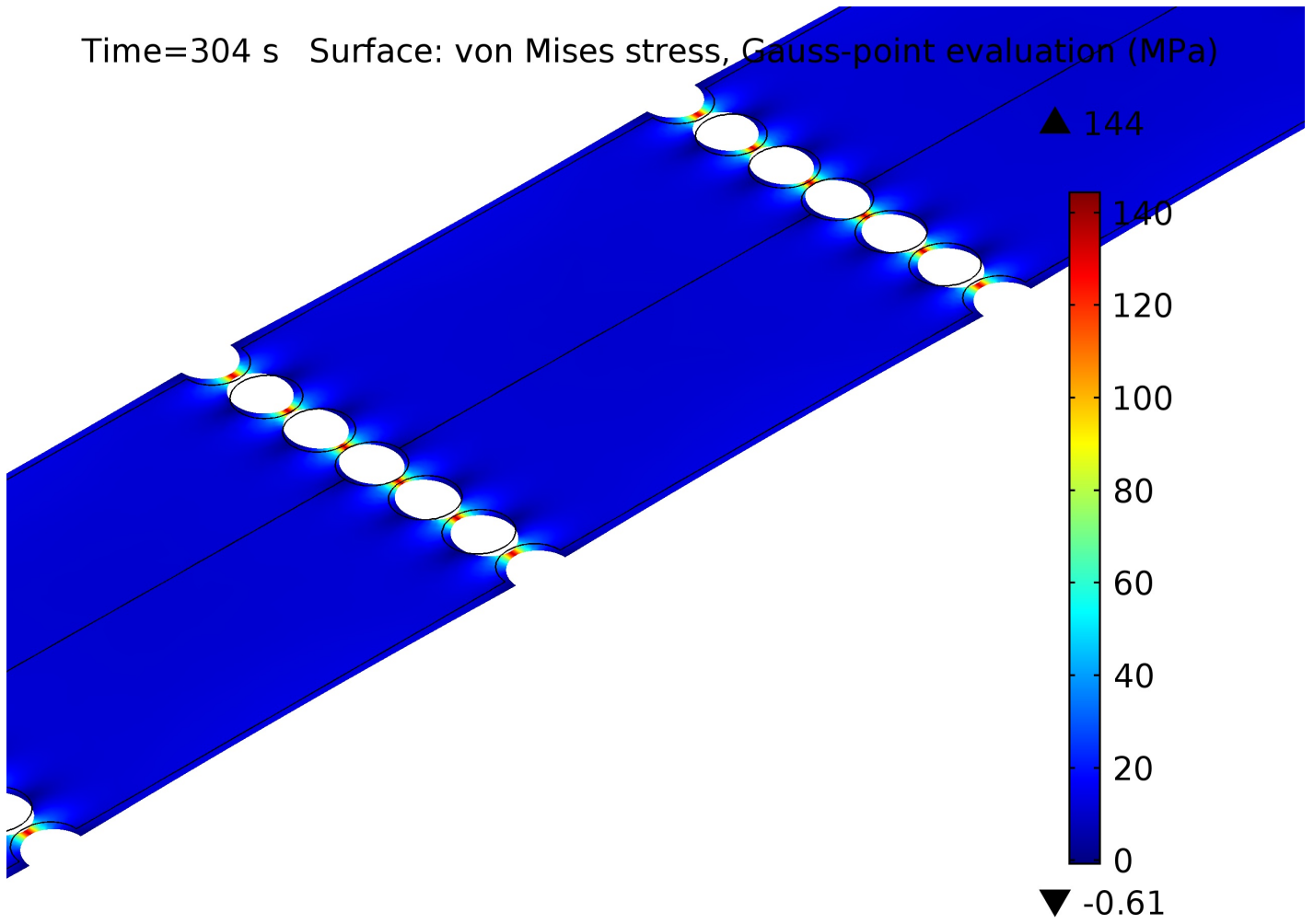


Figure 2 : Calculated Von Mises stress on silver melting strip.