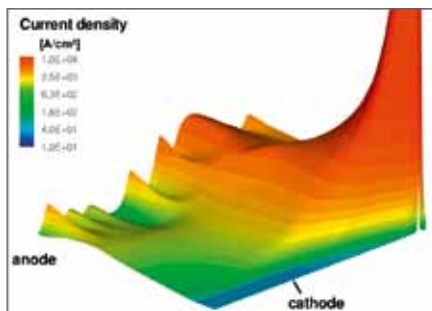


Chair for Power Electronics and Electromagnetic Compatibility

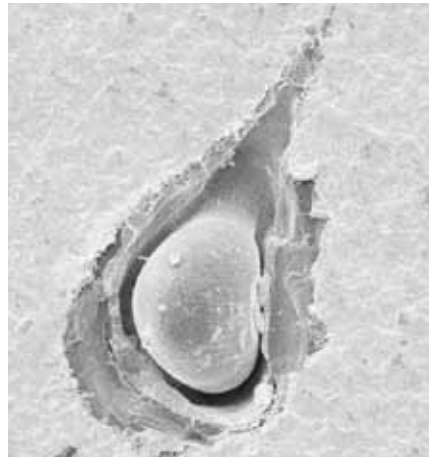
At Chemnitz University of Technology, the Chair of Power Electronics and Electromagnetic Compatibility is responsible for the education and research regarding power devices, thermal-mechanical problems of power electronic systems, power circuits and electromagnetic compatibility.

Reliability and Ruggedness of Power Devices

Ruggedness: Power devices must withstand overload conditions, they have to be rugged. Short circuit capability of high voltage IGBTs (SC I, SC II) is measured. A further point is the surge current capability of Si and SiC diodes. The reverse recovery behavior is of special interest. Switching behavior and ruggedness of high power diodes are investigated. Experimental analysis goes along with numerical device simulations. Detailed analysis of the electro-thermal processes in devices leads to design suggestions



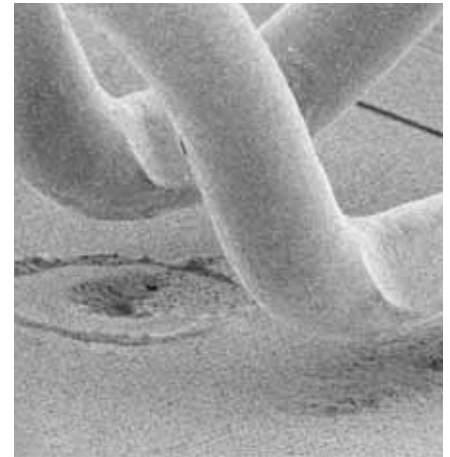
Simulation of current filaments in a high-voltage diode



Destruction of a power diode by a current filament

for improved ruggedness. Additionally, the group offers failure analysis, including opening of the power module for a profound analysis and the preparation of failure reports including evaluation. The group cooperates with Fraunhofer ENAS and can use optimal analysis tools, if necessary.

Reliability: Power devices are tested for their reliability and durability on eight self-built power cycling stations, between 100A and 400A, up to 2000A are in construction. Power cycling is the most important for life expectation of the devices. Research work is focused on detailed models for the failure mechanisms. Thermal-mechanical simulations are applied to illustrate local mechanical stresses and strains in the device resulting from the mismatch in the thermal expansion of the material layers.



Bond wire lift-off created by power cycling

Additional reliability test stations are hot reverse test (up to 2500V DC and 200°C) and high-humidity high temperature reverse bias test.

The group is involved in various national and international projects with global players from semiconductor industry, with automotive industry regarding electric and hybrid electric vehicles, in large offshore wind power, in inverters for solar plants. The research in different projects is supported by industry partners, SINTEF Norway, the EU, BMWi and BMBF, DFG and ESF/SAB.