

Characterization and Lifetime Testing

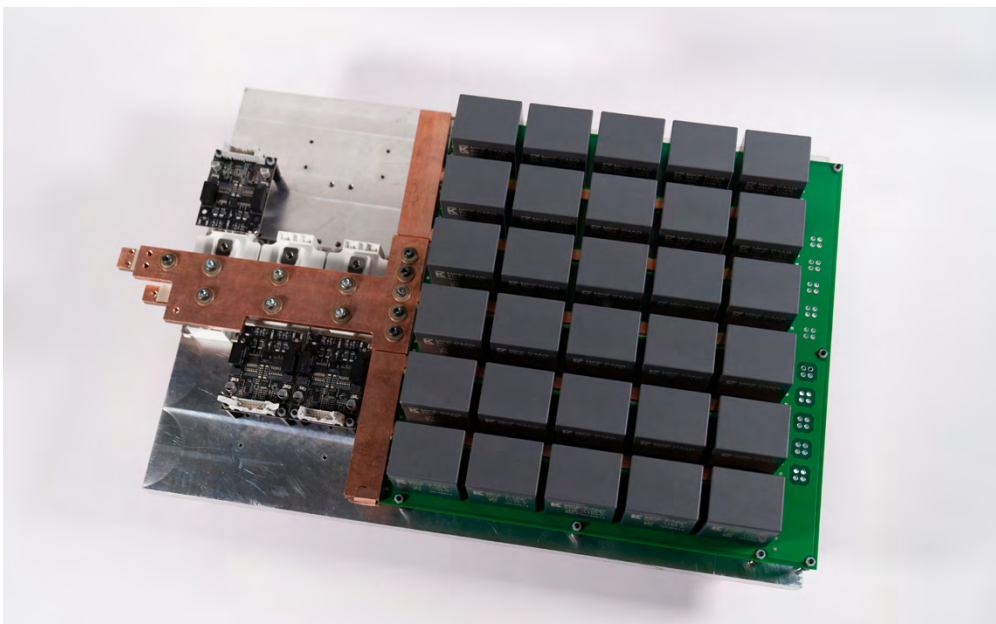
Capacitors

*Teardown of a DC-Link film capacitor
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Capacitors are an essential component in power electronics. They are mainly used as DC-Link or snubber capacitors. With increasing power density of converters and fast switching wide bandgap semiconductors the load on capacitors is increased. In view of this development, reliability of capacitors is becoming even more important.

Fraunhofer IISB is working in several fields concerning lifetime and reliability of capacitors:

- Lifetime testing of capacitors: Development of test procedures and test hardware
- Electrical characterization of capacitors
- Thermal characterization of capacitors
- Evaluation of capacitors for power electronic applications



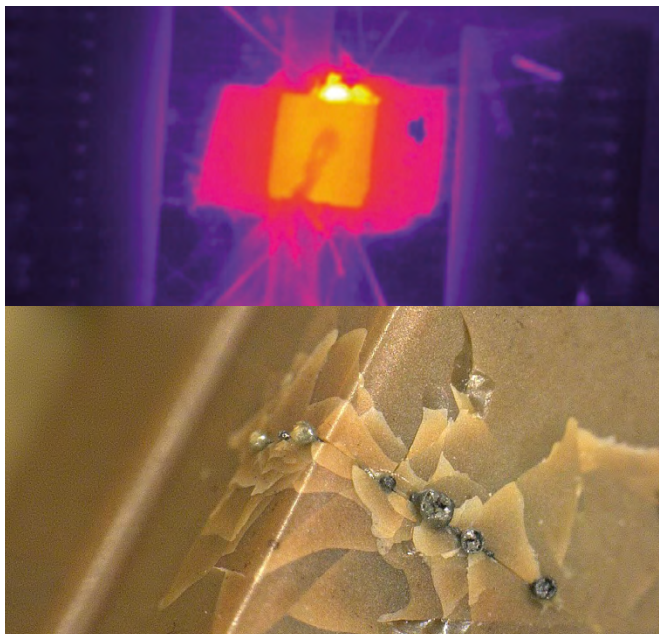
*Active power cycling test set up for capacitors up to 1000 μ F developed at the IISB
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Features

- Film, ceramic and electrolytic capacitors
- Capacitance from 1 nF to 1000 μF
- Typical nominal voltage 1200 V
- Load current up to 500 A

Lifetime testing

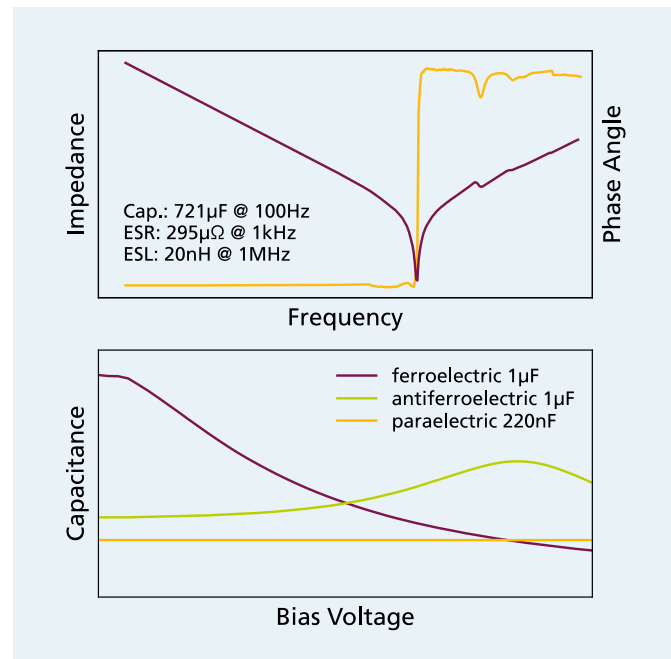
- Power cycling test
 - Active heating of capacitors
 - Rectangular AC current load
 - Switching frequencies up to 100 kHz
- High temperature load, damp heat (HTRB, H3TRB)
 - Online leakage and capacitance measurement
 - Up to 120 DUTs in one test run
 - Up to 200 °C, 3000 V
- Temperature shock
 - Air to air / liquid to liquid
 - 1 and 2 chamber test systems



Capacitors failed during active stress testing
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Failure analysis / Reverse engineering

- Cross sections
- Scanning acoustic microscopy SAM; X-ray
- Electron microscopy REM, EDX, FIB section
- Material analysis



Electric characterization of capacitors
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Characterization

- Capacitance, ESR, ESL
- Insulation resistance; leakage current
- Dependent on voltage, temperature and frequency

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