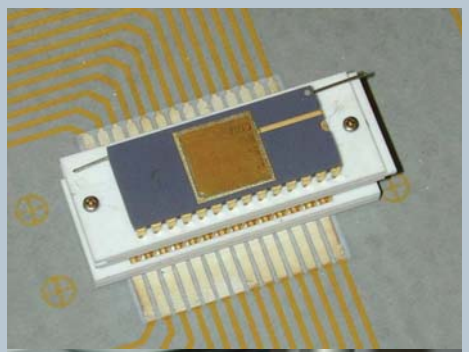
High Temperature Leakage Current Test System

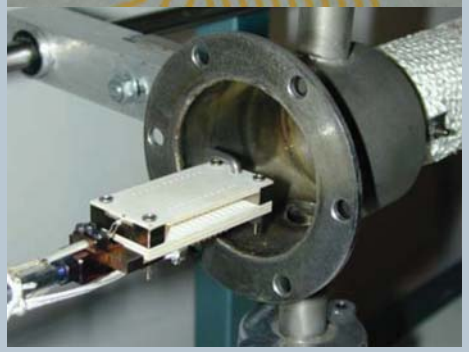
Application area: passive electronic components

IMOMEC
Institute for Materials Research
University of Hasselt
Associated Lab IMEC

In the future, a bigger amount of the sales value of a car will be represented by electronic modules and devices. The development of energy-efficient, fuel-saving engines would not have been possible without the implementation of intelligent combustion-management systems. Another important trend in the automotive sector is the integration of all kinds of control and sensor electronics closer to the engine, the generator and the brakes. The harsh environment in the vicinity of the engine for example imposes a far higher temperature stress on automotive electronics than for standard applications where the maximum operating temperature is below 125°C.

For novel automotive electronics components, new high-temperature electronic component have to be designed. At high temperatures, device parameter changes may occur such as increased series resistance, capacitance changes and increased leakage currents. In order to guarantee reliable operation, these components must be tested and qualified prior to market introduction. Such a test system is the IMOMEC High Temperature Leakage Current Measurement System (top image) that is dedicated to the evaluation of the behaviour of passive electronic components under thermal and electrical stress.





Measurements can be performed up to a temperature of 350°C. Stress voltages up to 300 V can be applied to the devices under test (DUT). For this measurement system, special high-temperature sample holders based on ceramic materials have been developed. The system consists of the furnace, a multiplexing stage, the power supplies for heating and stressing and the necessary multimeters. The measurement process and data logging is controlled by a data acquisition program. The electrical parameters of the DUTs are monitored in-situ during life test.

System description and specifications

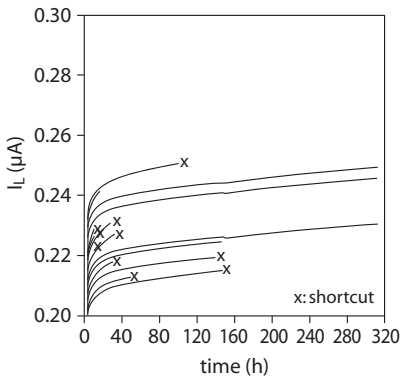
The test setup is able to stress and characterize up to 60 passive components simultaneously.

Parameter	Specification
Temperature range	30°C ... 350°C
Temperature stability	0.05°C
Supply voltage	0V ... 300V
Maximum supply current	300mA
Maximum measured current	1000mA
Maximum measured voltage	200V
Measurement resolution	< 0.1%
Measurement capacity	60 samples simultaneously

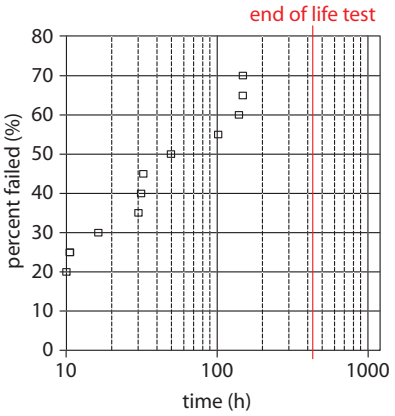
Measurement example

The example (left graph) shows the degradation of ceramic capacitors at 150V and 200°C ambient temperature. The leakage current is monotonically increasing until sudden device shortcut occurs (marked with "X").

The right image shows the times to failure for the same capacitor lot. These data can be fitted to a Weibull statistical distribution. The application of a suitable degradation model on these failure data allows the prediction of the component reliability under real-life conditions in the field.



Capacitor leakage current at 150V and 200°C



Times to failure for in-situ measurement
(see images p.1)

imec
aspire invent achieve

IMEC
Kapeldreef 75
B-3001 Leuven
Belgium

Ph. +32 16 28 18 80
Fax. +32 16 28 16 37
Katrien.Marent@imec.be

universiteit hasselt
INSTITUUT VOOR MATERIAALONDERZOEK

Institute for Materials Research - Hasselt University
Division IMOMEC, IMEC vzw
Wetenschapspark 1
B-3590 Diepenbeek
Belgium

Ph. +32 11 26 88 72
Fax. +32 11 26 88 99
ward.deceuninck@uhasselt.be