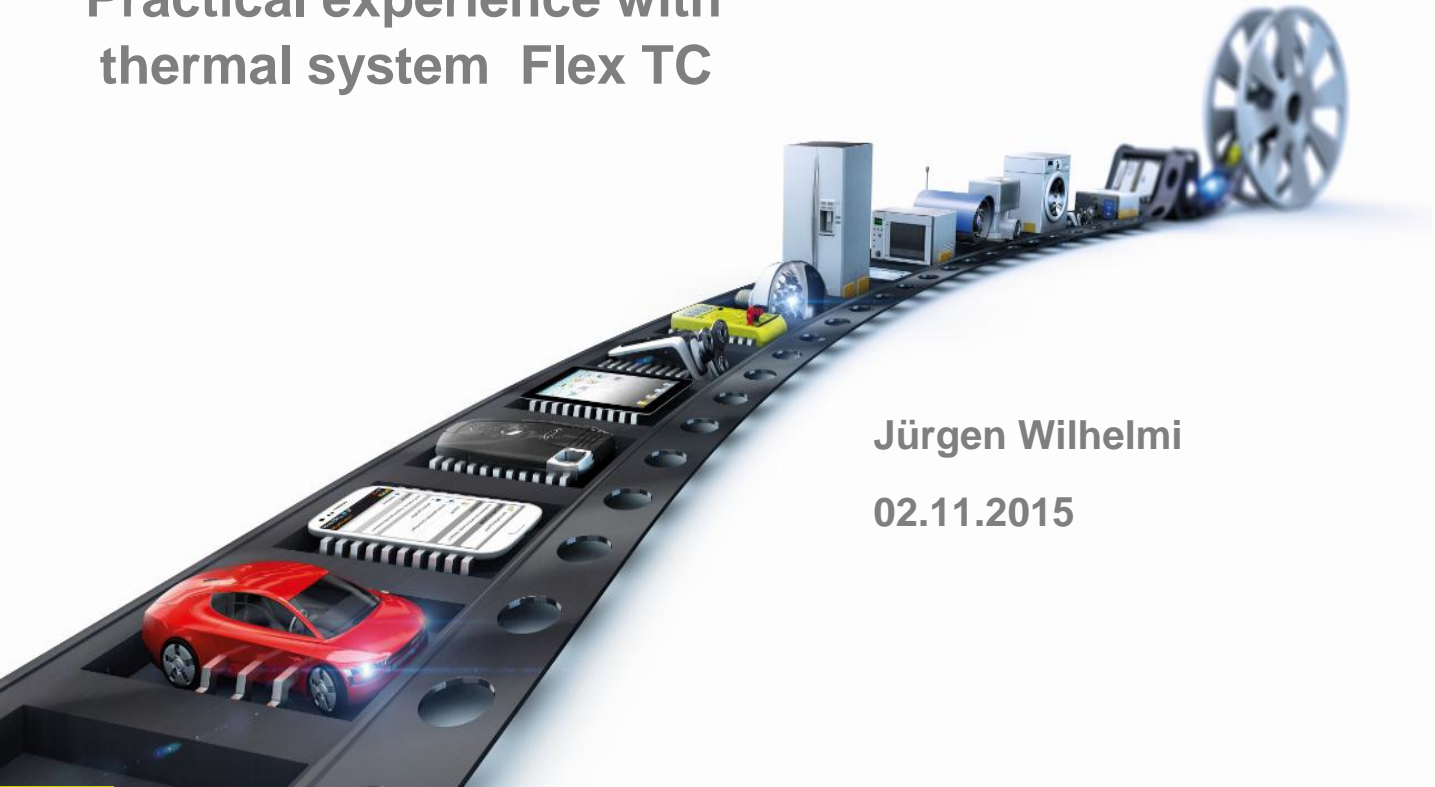


Practical experience with thermal system Flex TC



Jürgen Wilhelmi

02.11.2015

Motivation

- Customer requests for temperature parameters (SGP model)
- Search for heating/cooling equipment for measurements (including temperature parameters in SPICE models)
- Test in april 2015 with loaned equipment from J.P. Kummer (Flex TC)



Short survey

➤ Usability

Simple and quick possibility to perform measurements at various temperatures

➤ Characteristics:

Temperature range: -55 bis +175 °C bzw. -60 bis +300 °C (max TC)

Various plungers available (even custom specific)

Dimensions: ca. 50 cm x 35 cm x 20 cm

Weight: ca. 15 kg

➤ Technique:

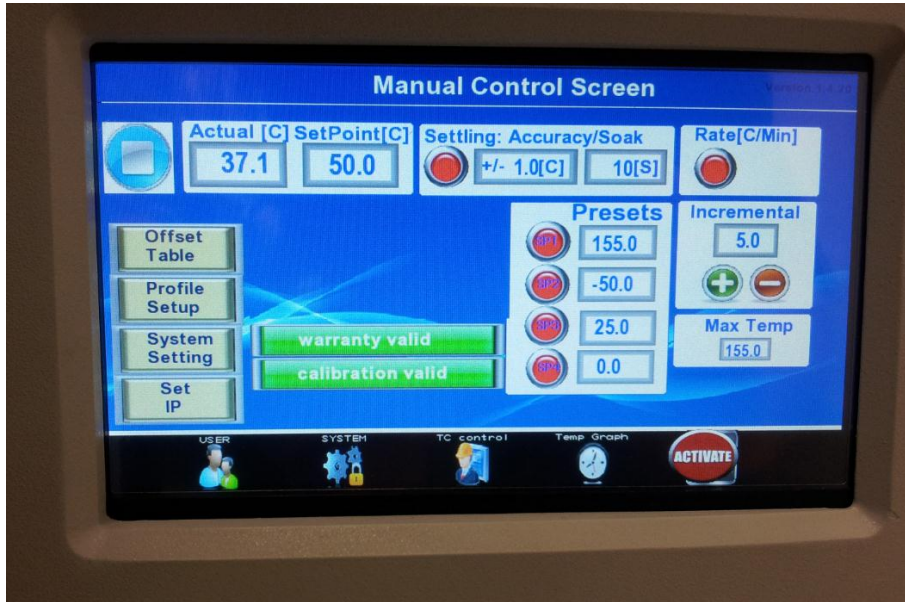
Heating/cooling by gas circulation (heating/cooling device in main device) und additional Peltier element inside head („plunger“)

➤ Temperature sensor placed inside plunger

➤ Price:

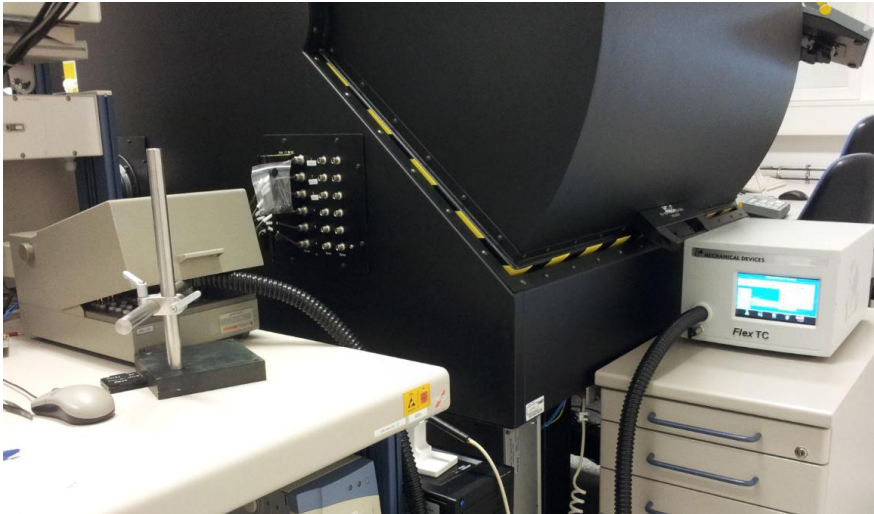
Ca. 20000 € incl. 3 plungers

Control panel



- Temperature setting directly by touchscreen
- Appliance very simple, no previous knowledge necessary.

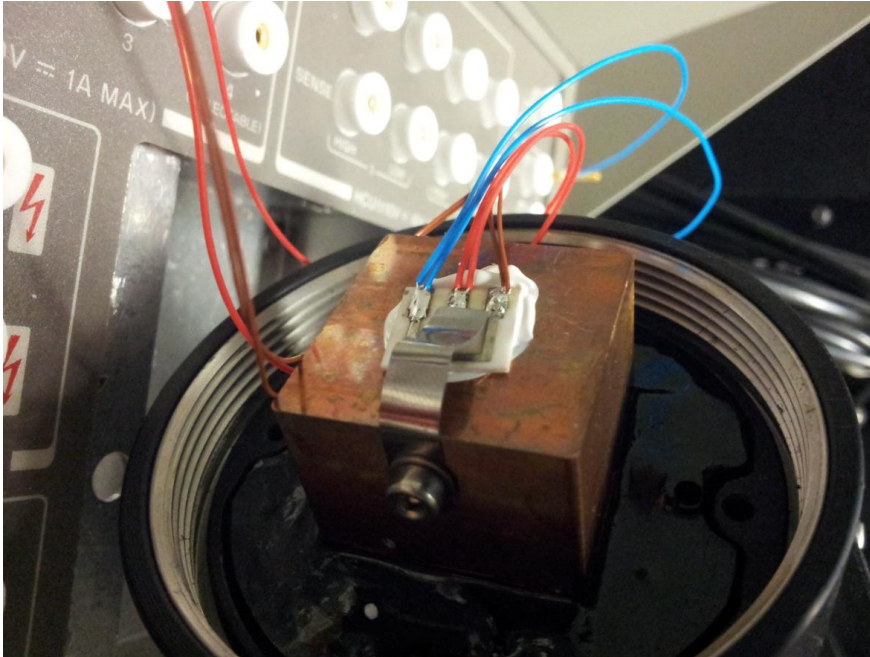
Test setting (1)



IC-CAP-measuring
system:

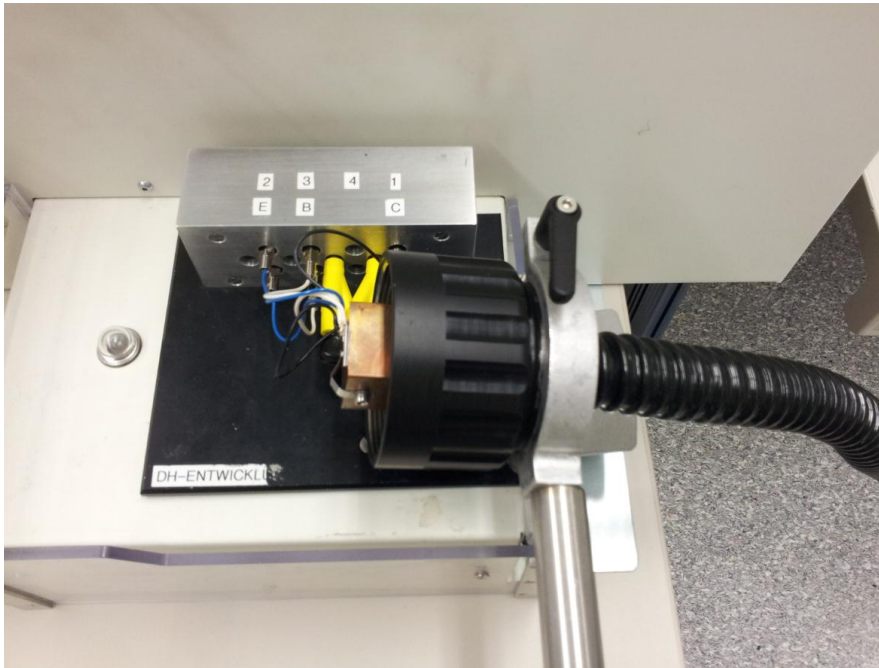
Measuring of Gummel
plots from
-50 °C to +150 °C
(using 25°C-steps)

Test setting (2)



- DUT mounting by using steel clip and thermal compound
- Adaptor available for complete shielding of measuring setup

Test setting (3)



Test setup at μ Parset

(Test system for high current/high voltage)

Results (1)

Temperature behaviour:

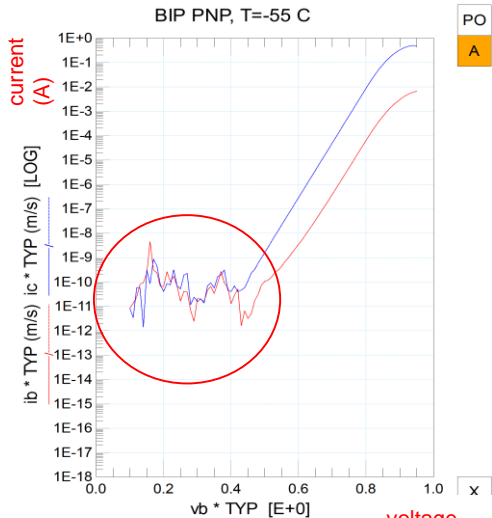
- Heating-/cooling rate: ca. 10 min (0°C to 100°C and 0°C to -50°C)
- Temperature deviation:

target temperature (°C)	temp. setting (°C) (including offset)	temp. measured (°C)
100	104	99.9 - 100.1
0	-1	0 - 0.1
-50	-53	-50.2 - -50.0

- Specification of manufacturer (+/- 0.2°C) is met
- Offset is to be determined dependent on used plunger

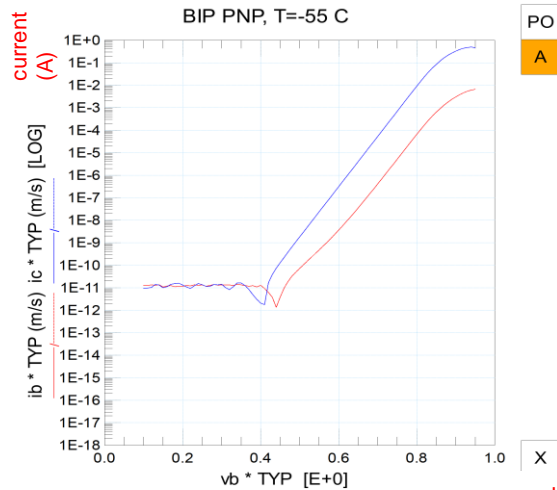
Results (2)

➤ Current measurement (Gummel plot) -50°C:



Plot bip/dc_fwd_TEMP/gummel_minus50C/ibic_vbe voltage (V)

Temperature control activated

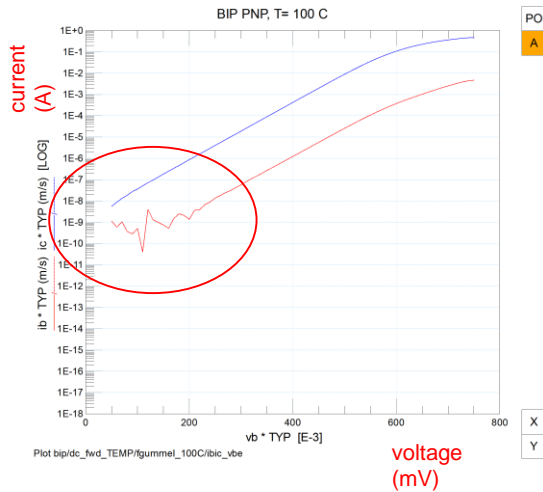


Plot bip/dc_fwd_TEMP/gummel_minus50C_ausgeschaltet/ibic_vbe voltage (V)

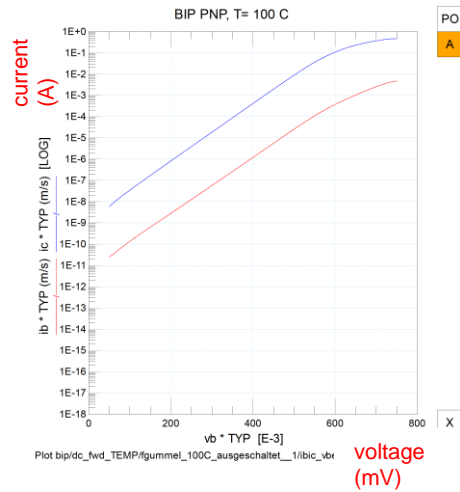
Temperature control deactivated

Results (3)

➤ Current measurement (Gummel plot) at 100°C:



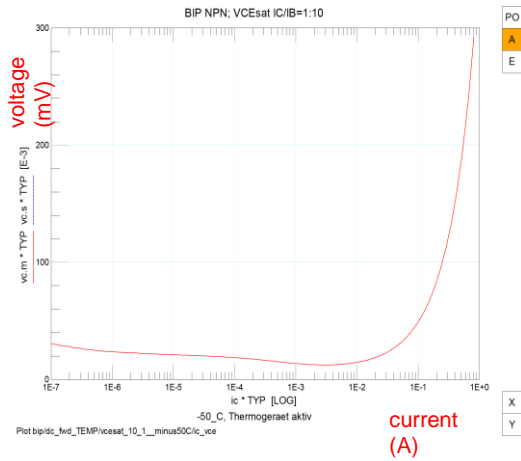
Temperature control activated



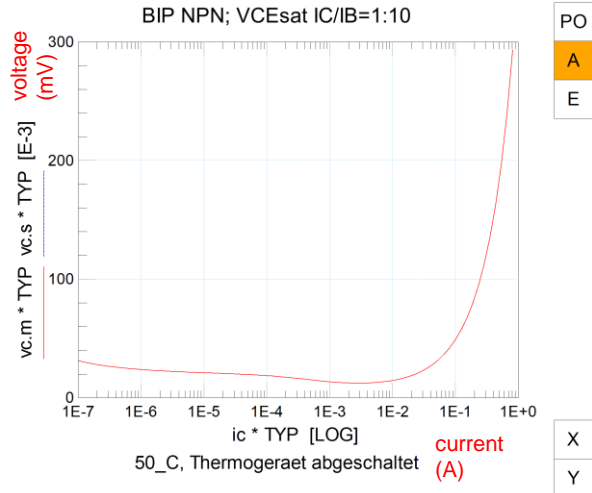
Temperature control deactivated

Results (4)

➤ Voltage measurement (VCEsat) bei -50°C:



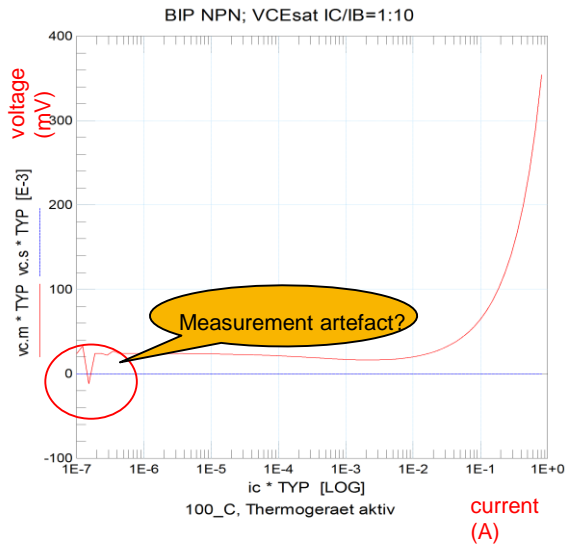
Temperature control activated



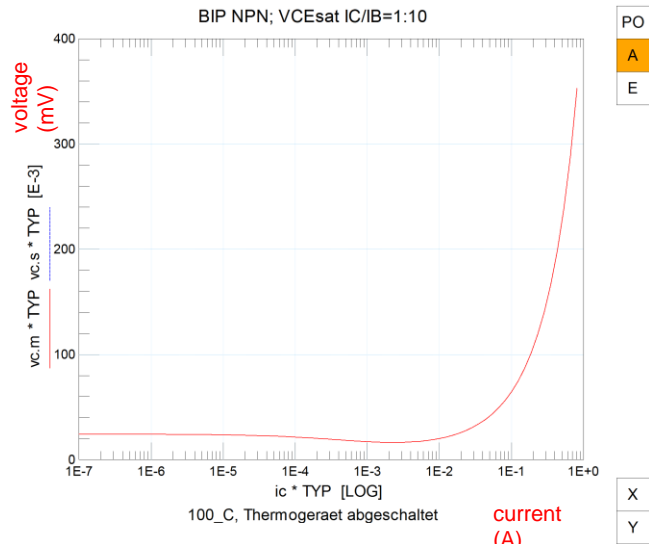
Temperature control deactivated

Results (5)

➤ Voltage measurement (VCEsat) bei 100°C:



Temperature control activated



Temperature control deactivated

Summary

➤ **Advantages:**

- Simple and quick possibility to perform measurements at various temperatures
- No previous knowledge necessary for using
- Mobility of temperature system
- Good temperature stability (+/- 0.2°C)

➤ **Disadvantages:**

- **Electrical noise when measuring low currents** < 10 nA (and possibly low voltages)
- Noise is appearing in heating and cooling
- Occuring of humidity/ice in cooling mode (but N₂-purging is possible)
- Heating and cooling rates lower than specified by manufacturer, but acceptable

➤ **Possible improvements:**

- Possibility of deactivating temperature controlling during measurement by software solution (manufacturer is trying to offer a software solution; information of G. Kölz)

Supplier / contact

<http://www.jpkummer.com/en/node/93>

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Thank you for your attention!

