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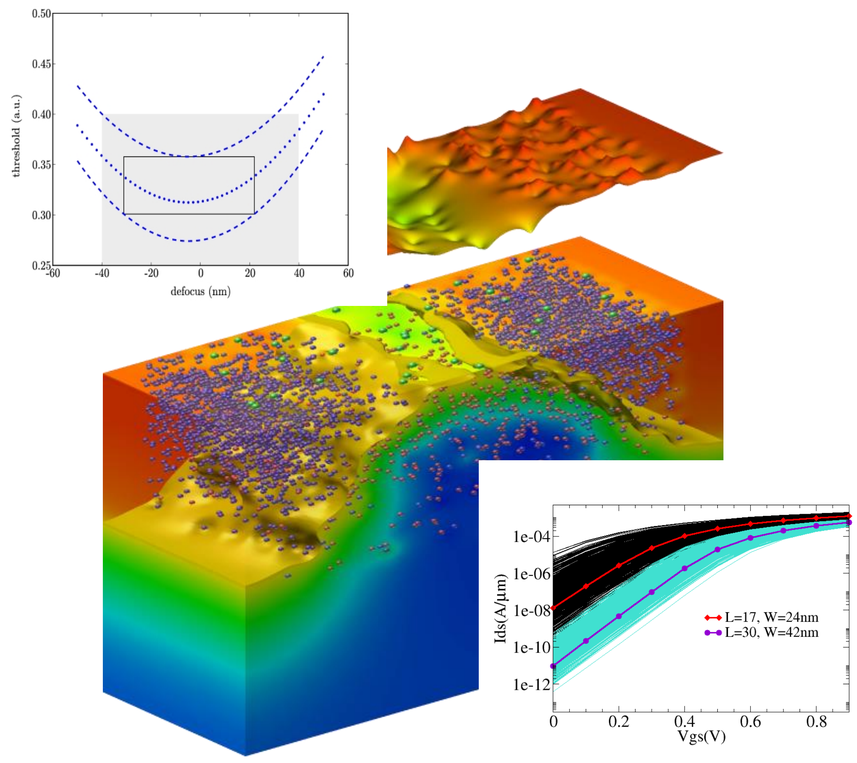
SUPERTHEME

Circuit Stability under Process Variability and Electro-Thermal Mechanical Coupling

General description

Process variations and their interactions with electrical, thermal and mechanical effects are getting more and more critical both for advanced *Moore Moore* and *More than Moore* devices and circuits. Effects from various sources of process variations, both systematic and stochastic, influence each other. Correlations are of key importance because they drastically affect the percentage of products which meet the specifications. Modelling and simulation (TCAD) offer the unique possibility to predefine process variations and trace their effects on subsequent process steps and on devices and circuits fabricated. Within SUPERTHEME, the most important weaknesses which limit the use of current TCAD software to study the influence of both systematic and stochastic process variability and its interaction with electro-thermal-mechanical effects have been removed, and the study of correlations has been enabled.



Left to right: feature size variations due to focus/dose variations in optical lithography; random dopant variations in 45 nm transistor; drive current variations due to some statistical process variations for two different transistor sizes

Goals / Objectives

- Development and demonstration of a full chain of software tools for the simulation of the impact of systematic and statistical process variations
- Development and enhancement of simulation modules as needed
- Quantification of process variations at their source
- Demonstration of the software system via *Moore than Moore* and *More Moore* benchmarks
- Transfer of results to exploitation via software house partner Gold Standard Simulations and at other industrial partners

Societal impact / Results

The software suite developed in SUPERTHEME enables the assessment and minimization of the impact of process variations on advanced *Moore than Moore* and *More Moore* devices and circuits. This helps to optimize fabrication processes, device and circuit properties, and finally yield in semiconductor fabrication, and contributes to enabling further applications of micro and nanoelectronics.

- Integrated variability simulation from equipment through process and device up to circuit level has been enabled and demonstrated
- Methodology and tools for the extraction of process variation aware compact models have been developed and demonstrated
- The tools have been applied to equipment and device optimization
- Commercialization of results has been successfully started

Looking ahead

Future developments are planned in three main directions:

- Internal use of SUPERTHEME software at partners' sites for the development and optimization of equipment, processes, devices and circuits
- Exploitation of the software developed via commercial offer of the SUPERTHEME partner Gold Standard Simulations
- Further extension of the SUPERTHEME software to sub-10 nm devices within the follow-up Horizon 2020 project SUPERAID7

Partners

- Fraunhofer IISB, Erlangen, and IIS/EAS, Dresden
- ams AG, Graz
- Gold Standard Simulations Ltd, Glasgow
- University of Glasgow
- Technische Universität Wien
- ASML Netherlands B.V., Veldhoven
- HQ-Dielectrics GmbH, Dornstadt
- IBS ion beam services, Rousset
- Laser Systems & Solutions of Europe, Genneviliers

Countries involved

- Germany
- Austria
- France
- Netherlands
- United Kingdom

Additional information

More information is given at www.supertheme.eu

This includes among others

- Project highlights
- Public deliverables, posters, information on software tools
- Slides from SUPERTHEME workshop at ESSDERC 2015
- Currently 30 publications on SUPERTHEME results

SUPERTHEME

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