
Plan Overview

A Data Management Plan created using DMPonline.be

Title: Calibration of TCAD simulators for sub-2nm logic nodes with advanced 2D and 3D metrology techniques including SPM-based scalpel Scanning Spreading Resistance Microscopy

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Funder: Fonds voor Wetenschappelijk Onderzoek - Research Foundation Flanders (FWO)

Template: FWO DMP (Flemish Standard DMP)

Project abstract:

As the semiconductor industry moves towards ultra-scaled transistor dimensions and adopts advanced architectures, accurate simulations are key for developing new sub-2nm logic nodes. In scaled devices even the smallest variations of the structural dimensions, process conditions, carrier distribution and activation rate can cause significant variations in the devices' electrical properties. For this reason, it is crucial that Technology Computer-Aided Design (TCAD) simulations are calibrated to accurate metrology data obtained from the inside of real-world devices, enhancing the prediction accuracy, and reducing the necessity for conducting multiple costly experimental iterations. The project focuses on combining the development of scalpel Scanning Spreading Resistance Microscopy (s-SSRM) for gate-all-around transistors, a currently absent capability, with TCAD calibration. Additional inputs from other metrology techniques, such as Transmission Electron Microscopy, Energy Dispersion X-Ray spectroscopy, Nano-Beam electron Diffraction and device current-voltage characteristics, will also be implemented into the TCAD simulations. By combining advanced metrology with calibrated TCAD simulations, predictions will be available with accuracy levels unattainable through other means, as well as a very cost-efficient tool for design optimization.

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Calibration of TCAD simulators for sub-2nm logic nodes with advanced 2D and 3D metrology techniques including SPM-based scalpel Scanning Spreading Resistance Microscopy

Application DMP

Questionnaire

The questions in this section should only be answered if you are currently applying for FWO funding.
Are you preparing an application for funding?

- No

Calibration of TCAD simulators for sub-2nm logic nodes with advanced 2D and 3D metrology techniques including SPM-based scalpel Scanning Spreading Resistance Microscopy

FWO DMP (Flemish Standard DMP)

1. Research Data Summary

List and describe all datasets or research materials that you plan to generate/collect or reuse during your research project. For each dataset or data type (observational, experimental etc.), provide a short name & description (sufficient for yourself to know what data it is about), indicate whether the data are newly generated/collected or reused, digital or physical, also indicate the type of the data (the kind of content), its technical format (file extension), and an estimate of the upper limit of the volume of the data.

				Only for digital data	Only for digital data	Only for digital data	Only for physical data
Dataset Name	Description	New or reused	Digital or Physical	Digital Data Type	Digital Data format	Digital data volume (MB/GB/TB)	Physical volume
		<i>Please choose from the following options:</i> <ul style="list-style-type: none"> • Generate new data • Reuse existing data 	<i>Please choose from the following options:</i> <ul style="list-style-type: none"> • Digital • Physical 	<i>Please choose from the following options:</i> <ul style="list-style-type: none"> • Observational • Experimental • Compiled/aggregated data • Simulation data • Software • Other • NA 	<i>Please choose from the following options:</i> <ul style="list-style-type: none"> • .por, .xml, .tab, .csv, .pdf, .txt, .rtf, .dwg, .gml, ... • NA 	<i>Please choose from the following options:</i> <ul style="list-style-type: none"> • <100MB • <1GB • <100GB • <1TB • <5TB • <10TB • <50TB • >50TB • NA 	
AFM data	Scanning Spreading Resistance Microscopy (SSRM), Conductive Atomic Force Microscopy (C-AFM) PeakForce or contact mode AFM data (height and adhesion/deformation)	Generate new data	Digital	Experimental	.spm, .png, .csv, .txt	<100GB	
Imaging data	Optical microscope data, Transmission Electron Microscopy (TEM) or Scanning Electron Microscopy (SEM) data to image test material	Generate new data	Digital	Experimental	.png, .jpg, .tiff	<1GB	
Data analysis projects	Data analysis projects in software such as jmp, Origin, phyto	Generate new data	Digital	Compiled/aggregated data	.jmp, .csv, .opju	<100GB	
TCAD Simulation data	TCAD software simulation projects and outputs	Generate new data	Digital	Simulation data	.tdr, .txt, .plt, .log, .cmd, .csv	<5TB	
Test material	Cross-sectioned test-structures and integrated circuits	Generate new data	Physical	NA	NA	NA	Dozens of wafer coupons of <1cm ² area
Dissemination files	Presentations and documents used to disseminate research outputs	Generate new data	Physical	Compiled/aggregated data	.docx, .ppt	<100GB	

If you reuse existing data, please specify the source, preferably by using a persistent identifier (e.g. DOI, Handle, URL etc.) per dataset or data type:

NA

Are there any ethical issues concerning the creation and/or use of the data (e.g. experiments on humans or animals, dual use)?

Describe these issues in the comment section. Please refer to specific datasets or data types when appropriate.

- No

Will you process personal data? If so, briefly describe the kind of personal data you will use in the comment section. Please refer to specific datasets or data types when appropriate.

- No

Does your work have potential for commercial valorization (e.g. tech transfer, for example spin-offs, commercial exploitation, ...)? If so, please comment per dataset or data type where appropriate.

- No

Do existing 3rd party agreements restrict exploitation or dissemination of the data you (re)use (e.g. Material/Data transfer agreements/ research collaboration agreements)? If so, please explain in the comment section to what data they relate and what restrictions are in place.

- Yes

Device processing data, which is used to calibrate TCAD decks, is typically confidential due to (core)partner contracts

Are there any other legal issues, such as intellectual property rights and ownership, to be managed related to the data you (re)use? If so, please explain in the comment section to what data they relate and which restrictions will be asserted.

- No

2. Documentation and Metadata

Clearly describe what approach will be followed to capture the accompanying information necessary to keep data understandable and usable, for yourself and others, now and in the future (e.g., in terms of documentation levels and types required, procedures used, Electronic Lab Notebooks, README.txt files, Codebook.tsv etc. where this information is recorded).

Readme.txt files come with each dataset to describe them in an understandable way

Will a metadata standard be used to make it easier to find and reuse the data? If so, please specify (where appropriate per dataset or data type) which metadata standard will be used. If not, please specify (where appropriate per dataset or data type) which metadata will be created to make the data easier to find and reuse.

- No

Our research group does not usually use metadata standards, although datasets intrinsically contain metadata. For example, simulation files have log file containing parameters and models used, and AFM data contains the measurement parameters used during data acquisition.

3. Data storage & back-up during the research project

Where will the data be stored?

The data will be stored on imec's OneDrive, Sharepoint and intranet folders.

How will the data be backed up?

The data is backed up semi-instantaneously when uploaded and periodically afterwards, with access to previous versions.

Is there currently sufficient storage & backup capacity during the project? If yes, specify concisely.

If no or insufficient storage or backup capacities are available, then explain how this will be taken care of.

- Yes

How will you ensure that the data are securely stored and not accessed or modified by unauthorized persons?

Imec has strict security measures in place, and the folders will only be shared with the authorized personnel.

What are the expected costs for data storage and backup during the research project? How will these costs be covered?

Data storage and back up costs are covered by imec.

4. Data preservation after the end of the research project

Which data will be retained for at least five years (or longer, in agreement with other retention policies that are applicable) after the end of the project? In case some data cannot be preserved, clearly state the reasons for this (e.g. legal or contractual restrictions, storage/budget issues, institutional policies...).

Digital data will be retained for at least five years after the end of project. Physical samples will not be stored for more than 2 years after their growth due to the company's policy. However, the recipes are traceable and can be requested to imec's process/integration engineers.

Where will these data be archived (stored and curated for the long-term)?

The data will be stored on imec's OneDrive, Sharepoint and intranet folders.

What are the expected costs for data preservation during the expected retention period? How will these costs be covered?

Data preservation costs will be covered by imec.

5. Data sharing and reuse

Will the data (or part of the data) be made available for reuse after/during the project? In the comment section please explain per dataset or data type which data will be made available.

- Yes, in a restricted access repository (after approval, institutional access only, ...)

All experimental and simulation output data is available upon reasonable request after publication. Material and sample specific processing data might be subject to confidential restrictions and will be disclosed upon reasonable request.

If access is restricted, please specify who will be able to access the data and under what conditions.

All experimental and simulation data is available upon reasonable request. Material and sample specific processing data might be subject to confidential restrictions and will be disclosed upon reasonable request.

Are there any factors that restrict or prevent the sharing of (some of) the data (e.g. as defined in an agreement with a 3rd party, legal restrictions)? Please explain in the comment section per dataset or data type where appropriate.

- Yes, Intellectual Property Rights
- Yes, Other

Sharing material and sample specific processing data might be subject to confidential restrictions and geopolitical agreements and will be disclosed upon reasonable request. Calibrated TCAD decks are typically the result of several years of work, and are not disseminated without negotiation. The outcome of these TCAD simulations are shared.

Where will the data be made available? If already known, please provide a repository per dataset or data type.

Depending on the size of the data, it will be shared either via imec's SharePoint (< 1 GB) or via Azure data lake store (> 1 GB).

When will the data be made available?

Research results will be made available upon publication.

Which data usage licenses are you going to provide? If none, please explain why.

To be specified.

Do you intend to add a PID/DOI/accession number to your dataset(s)? If already available, you have the option to provide it in the comment section.

- No

What are the expected costs for data sharing? How will these costs be covered?

Data sharing costs shall be covered by imec.

6. Responsibilities

Who will manage data documentation and metadata during the research project?

Andrea Pondini

Who will manage data storage and backup during the research project?

Andrea Pondini

Who will manage data preservation and sharing?

Pierre Eyben

Who will update and implement this DMP?

Andrea Pondini