Plan Overview

A Data Management Plan created using DMPonline.be

Title: Sputtered Epitaxial Perpendicular MTJs for Next-Generation MRAM

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Principal Investigator: Hannah Tran

Data Manager: Hannah Tran

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

Template: FWO DMP (Flemish Standard DMP)

Principal Investigator: Hannah Tran

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Project abstract:
The semiconductor industry is undergoing a transformative shift fueled by AI-driven applications, underscoring the importance of advanced memory technologies. While conventional memory solutions like SRAM, DRAM, and Flash encounter challenges in performance and power efficiency, Magnetic Random Access Memory (MRAM) offers compelling advantages including low latency, power efficiency, and scalability. However, regardless of the writing mechanisms used in MRAM, such as spin-transfer torque (STT), spin-orbit torque (SOT), and voltage-control-magnetic-anisotropy (VCMA), MRAM devices encounter inherent issues including high switching energy and reliability concerns. To address these issues, this research approaches from material aspect, focuses on developing epitaxial Magnetic Tunneling Junctions (MTJ). By exploring new materials and improving material quality to reduce scattering during read/write processes and enhance the tunneling magnetoresistance (TMR) ratio, this research lays the groundwork for the development of high-performance MTJs that can be seamlessly integrated into standard MRAM processing during production. Through the advancement of epitaxial MTJ development, this project aims to accelerate the commercialization of MRAM technologies, catering to the evolving needs of various sectors for advanced memory solutions. This initiative will drive innovation and foster economic growth within the semiconductor industry.

ID: 214132

Start date: 10-10-2023

End date: 01-11-2028

Last modified: 01-04-2025

Sputtered Epitaxial Perpendicular MTJs for Next-Generation MRAM
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.

Data name	New or reused	Digital or Physical	Digital Data Type	Digital Data format	Digital data volume (MB/GB/TB)
X-ray diffraction/reflection patterns	Generate new data	Digital	Experimental	.txt .rasx	<100GB
AFM/TEM/SEM images	Generate new data	Digital	Experimental	.jpg .tif	<100GB
Experiment log file	Generate new data	Digital	Experimental	.xlsx	<10GB
Magnetic measurement	Generate new data	Digital	Experimental	.txt	<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.

- No

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).

The X-ray and magnetic data will be saved with header and units in .txt file to allow reading by any text-reading application and processed. The data in image format will be saved in .jpg or .tif with data is embedded and can be retrieved by appropriate applications.
The details of experiments are documented in .xlsx files with detailed conditions and sample IDs.

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.

- Yes

The metadata always pertains to a specific generation of wafers, samples, or devices. It is then supplemented with additional details regarding the specific characterization or simulation conducted.

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

Where will the data be stored?

The data is stored in IMEC' s servers.

How will the data be backed up?

IMEC's central servers and cloud offer ample storage and backup capacity.

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

IMEC's server is capable.

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

The assigned folders requires authorization by the project managers and IMEC ICT team.

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

No cost is expected.

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...).

Both raw and analysed data will be retained.

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

Both raw and analysed data are stored in directories on IMEC's intranet.

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

No cost is expected.

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, ...)

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

The PhD student, Tran Thi Thu Huong, is responsible for data documentation, and access to the data is granted upon request and collaboration.

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.

- No

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

Upon request by mail. A sharing method will be discussed.

When will the data be made available?

Upon publication of the research results

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

CC-BY-NC-SA-4.0

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?

No cost is expected.

6. Responsibilities

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

The PhD student, Tran Thi Thu Huong, and IMEC will manage data documentation and metadata during the research project.

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

The PhD student, Tran Thi Thu Huong, and IMEC will manage data storage and backup during the research project.

Who will manage data preservation and sharing?

The PhD student, Tran Thi Thu Huong, funded by this grant, is responsible for data preservation and reuse.

Who will update and implement this DMP?

The PhD student, Tran Thi Thu Huong, funded by this grant, is responsible for updating and implementing this DMP.