Electrical control of magnetic racetrack memory devices based on synthetic antiferromagnetic materials

A Data Management Plan created using DMPonline.be

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Project abstract:

With the exponential growth of data in recent years, charge-based memory technologies are encountering numerous obstacles for further increasing density. Using spin to store information, spintronic-based memory technologies offer significant benefits such as non-volatility, low power consumption, and high endurance.

Alongside the advancements in MRAM technologies, racetrack memory (RTM), where the bit information is encoded in magnetic domains along a track, has also attracted significant attention. The capacity to host numerous domains within a track and to construct 3D architectures are key features to reach ultra-high-density RTM. However, the experimental demonstration of electrical control of RTM is still lacking. Challenges are related to the integration of magnetic tunnel junctions (MTJ) access units, which significantly influence the dynamics of domain nucleation and motion in ferromagnetic nanotracks.

This PhD project aims to study the electrical control of RTM based on synthetic antiferromagnetic (SAF) as a nanotrack with MTJs as electrical read/write components. We will focus on the physical understanding of the domain nucleation and motion processes, as well as the potential to increase the density of data storage by tuning the strength of the antiferromagnetic coupling. Therefore, this study will provide a physical understanding of domain dynamics in SAF materials at the nanoscale, which can pave the way toward a full electrical operation of RTM devices.

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Electrical control of magnetic racetrack memory devices based on synthetic antiferromagnetic materials DPIA

DPIA

Have you performed a DPIA for the personal data processing activities for this project?

Question not answered.

Electrical control of magnetic racetrack memory devices based on synthetic antiferromagnetic materials GDPR

GDPR

Have you registered personal data processing activities for this project?

Question not answered.

Electrical control of magnetic racetrack memory devices based on synthetic antiferromagnetic materials Application DMP

Questionnaire

Describe the datatypes (surveys, sequences, manuscripts, objects …) the research will collect and/or generate and /or (re)use. (use up to 700 characters)

Question not answered.

Specify in which way the following provisions are in place in order to preserve the data during and at least 5 years after the end of the research? Motivate your answer. (use up to 700 characters)

Question not answered.

What's the reason why you wish to deviate from the principle of preservation of data and of the minimum preservation term of 5 years? (max. 700 characters)

Question not answered.

Are there issues concerning research data indicated in the ethics questionnaire of this application form? Which specific security measures do those data require? (use up to 700 characters)

Question not answered.

Which other issues related to the data management are relevant to mention? (use up to 700 characters)

Question not answered.

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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
		Please choose from the following options: • Generate new data • Reuse existing data	*Please choose from the following options:* • Digital • Physical	*Please choose from the following options:* • Observational • Experimental • Compiled/aggregated data • Simulation data • Software • Other • NA	*Please choose from the following options:* • .por, .xml, .tab, .csv,.pdf, .txt, .rtf, .dwg, .gml, … • NA	*Please choose from the following options:* • <100MB • <1GB • <100GB • <1TB • <5TB • <10TB • <50TB • >50TB • NA	
Simulation Data	Data from micromagnetic simulations	Generate new data	Digital	Simulation data	.txt	<100GB	
Experimental Data	Data from experimental measurements: electrical measurement and magnetic imaging	Generate new data	Digital	Experimental	.txt, .jpg, .png	<100GB	
Samples		Generate new data	Physical				<100 samples

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:

Not applicable.

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

Some data will be restricted to imec/KUL only.

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).

All the generated data will be stored on IMEC's servers and accessed using Microsoft SharePoint.
All simulation data will be commented and a README file will provided.
All experimental data will be gathered in a folder with README files.
All generated samples will be stored in a dedicated place in IMEC's cleanroom.

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

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

Where will the data be stored?

All the generated data will be stored on IMEC's servers and accessed using Microsoft SharePoint. All generated samples will be stored in a

dedicated place in IMEC's cleanroom.

How will the data be backed up?

All generated data will be backup up in Microsoft OneDrive.

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 and KUL ensure sufficient data storage in OneDrive.

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

Data access in OneDrive is controlled by myself.

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

OneDrive for Business is free for staff of imec/KUL.

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...).

All data declared above will be retained for at least five years.

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

All the generated data will be stored on IMEC's servers and accessed using Microsoft SharePoint. All generated samples will be stored in a dedicated place in IMEC's cleanroom. The responsible Dr. Van Dai Nguyen will ensure that all the data is conserved during and after the research, for at least 5 years.

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

OneDrive for Business is free for staff of imec/KUL.

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.

Data will be available for members of the team. Data for other people may be available on request after approval by the responsible.

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

Some data will be restricted to imec/KUL only.

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

A specific repository will be chosen like the KU Leuven RDR.

When will the data be made available?

Upon publication of research results

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

Data usage licenses will be discussed with imec/KUL before any licences are granted.

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?

KU Leuven RDR is free.

6. Responsibilities

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

Myself (the researcher)

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

Myself (the researcher)

Who will manage data preservation and sharing?

Myself (the researcher)

Who will update and implement this DMP?

Myself (the researcher)