COMBINING FLUORESCENCE MICROSCOPY AND MICROFLUIDIC DEVICES AS AN INNOVATIVE IN-SITU CHARACTERIZATION TECHNIQUE FOR THIN-FILM (NANO)COMPOSITE MEMBRANES

A Data Management Plan created using DMPonline.be

Creator: Scout Caspers

Affiliation: KU Leuven (KUL)

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

Template: FWO DMP (Flemish Standard DMP)

Principal Investigator: Scout Caspers

Project Administrator: Laurens Rutgeerts

Grant number / URL: 1SF9823N

ID: 196877

Start date: 01-11-2022

End date: 31-10-2026

Project abstract:

Although interfacial polymerized (IP) polyamide (PA) thin-film composite membranes (TFC) are dominant in many industrial separation processes, they suffer from a trade-off between permeance and selectivity, which can be countered by incorporating porous and selective fillers into the selective top-layer to form thin-film nanocomposite (TFN) membranes. However, recently it was shown that the exact functioning of these fillers is more complex than initially considered. It is believed that the acid generated during IP partially/fully degrades acid-sensitive fillers (e.g., ZIF-8) and that this strongly influences film formation. Epoxide chemistry was recently proven to be an excellent platform for the development of novel nanofiltration membranes, with good performance under harsh conditions. However, fundamental understanding of the relationship between process parameters and PEE film properties and membrane performance is still lacking due to the inherent complexity of the interfacial system. In - situ characterizing the interfacial initiated polymerization (IIP) reaction can be a huge advantage. Therefore, fluorescence microscopy and microfluidic chips will be combined as an in-situ characterization technique to study TFNs and epoxide-based membranes by conducting phase inversion, IP and IIP inside the channels of microfluidic chips and selective probing with fluorescence molecules.

Last modified: 10-02-2023

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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)

The project will generate three main types of raw, new data, all stored in digital format:
(1) Numeric data files. Techniques: results of image and video analysis, fluorescence intensity assay data, XRD files, SEM images, TEM images, zeta-potential data, contact angle measurements, infra-red data, viscosity data (.csv), membrane filtration data (excel),
(2) Images and videos. Techniques: optical microscopy images and videos, scanning electron
microscopy, confocal fluorescence microscopy images and videos, Raman spectroscopy, ...
(3) Optimized recipes and protocols for micromold soft lithography, micromold design files, sensor fabrication (incl. lithographic protocols), performing assays, …
(4) Labnotes
Volume of data: videos generated at optical and fluorescence microscope are commonly in the order of GB. Per day of imaging typically 10 - 20 GB of data is generated. At least 1 day per week optical imaging is performed.

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)

The applicant (S. Caspers) will curate all data he generates in consultation with the PI
(I.Vankelecom). The persons responsible for data preservation are Scout Caspers and Laurens Rutgeerts (Lab and Project Coordinator MTG). All data will be stored via a secure cloud storage solution (KU Leuven network drives and OneDrive) and additional external hard drives. This offers sufficient space and enables efficient sharing of data with other research group members when required. The same solution will be used for long-term storage.
Files will be named according to a pre-agreed convention and will be accompanied by a README file which will describe the directory hierarchy and file naming convention. Each directory will contain an INFO.txt file describing the experimental protocol used. This way, the data can be understood by other team members and can be reused in the future.

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)

We do not wish to deviate.

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)

NA

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

No other issues.

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DPIA

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

- Not applicable

COMBINING FLUORESCENCE MICROSCOPY AND MICROFLUIDIC DEVICES AS AN INNOVATIVE IN-SITU CHARACTERIZATION TECHNIQUE FOR THIN-FILM (NANO)COMPOSITE MEMBRANES GDPR

GDPR

Have you registered personal data processing activities for this project?

- Not applicable

COMBINING FLUORESCENCE MICROSCOPY AND MICROFLUIDIC DEVICES AS AN INNOVATIVE IN-SITU CHARACTERIZATION TECHNIQUE FOR THIN-FILM (NANO)COMPOSITE MEMBRANES

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
Membrane performance screening	After membrane fabrication/synthesis, they are characterized by dead-end filtration.	• Generate new data	• Digital • Physical	• Observational • Experimental	• .csv	• <100 MB	Membranes are stored in containers with water in a fridge.
SEM & TEM	Scanning and transmission electron microscopy are applied to visualize the fabricated membranes and MOFs at the nano-scale.	• Generate new data	• Digital	• Experimental	• .tiff • .txt	• <100 GB	
X-ray diffraction	To study the crystallinity of membranes and MOFs, XRD is used.	• Generate new data	• Digital	• Experimental	• .csv • .rd • .bak • .xrdml	• <1 GB	
Infrared spectroscopy	The chemical composition of the fabricated membranes will be studied using FTIR.	• Generate new data	• Digital	• Experimental	• .csv	• <1 GB	
Contact angle measurements	The hydrophilicity of fabricated membranes and microfluidic materials will be investigated using contact angle measurements.	• Generate new data	• Digital	• Experimental	• .csv • .tiff	• <1 GB	
Zeta-potential	The surface charge of membranes will be measured using zeta-potential measurements.	• Generate new data	• Digital	• Experimental	• .csv • .sop	• <1 GB	
Atomic force microscopy	The surface roughness of membranes and other samples will be studied using AFM.	• Generate new data	• Digital	• Experimental	• .txt • .gwy	• < 100 GB	
Viscosity measurements	The viscosities of polymer solution used for membrane fabrication will be determined by performing viscosity measurements.	• Generate new data	• Digital	• Experimental	• .csv	• <100 MB	
3D printing	3D prints are designed in AutoDesk software.	• Generate new data	• Digital	• Compiled/aggregated data	• .ipt • .stl • .sl1s	• <100 GB	
Soft Lithography	Microfluidic designs are created in KLayout software and transferred onto a photomask using a laserwriter.	• Generate new data	• Digital	• Compiled/aggregated data	• .GDS	• <100 MB	
Computational Fluid Dynamics	Modelling the flow of fluids in the designed microfluidic channels.	• Generate new data	• Digital	• Simulation data	• .wbpj	• <100 GB	
Microscopy	Optical and fluorescence microscopy for in situ characterization of I(I)P and phase inversion.	• Generate new data	• Digital	• Experimental	• .lif • .jpg • .gif	• <5TB	
Spectrofluorometer	Determine excitation and emission spectra of various samples.	• Generate new data	• Digital	• Experimental	• .txt • .FS	• <100 MB	
Raman spectroscopy	Raman spectroscopy for in situ characterization of I(I)P.	• Generate new data	• Digital	• Experimental	• .txt • .tvb	• <100 MB	

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).

Files will be named according to a pre-agreed convention and will be accompanied by a README file which will describe the directory hierarchy and file naming convention. Each directory will contain an INFO.txt file describing the experimental protocol used. The used procedures will be written down in a word file. This way, the data can be understood by other team members and can be reused in the future.

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

A README.txt file will be added to the appropriate datasets to describe file naming convention. From the file naming, the repositories will be able to better understand the origin and content of the data.

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

Where will the data be stored?

All data will be stored electronically on the personal KU Leuven One Drive and/or KU Leuven J drive for daily back-up. For large and raw data files (microscopy video's) external hard drives will be used.

How will the data be backed up?

The KU Leuven storage solutions like shared network drive (J-drive) and OneDrive make automatic back-ups. For data files too large for the shared drives (microscopy video's) an external hard drive will be used and backed-up monthly on another hard drive.

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?

Shared network drive (J-drive) and the KU Leuven personal OneDrive are secured with password protection, which is changed every year. Access to these files will be restricted to members of the lab group who have been granted permission, with ICT permissions being limited to those who need it. Students, for example, will not be given access to sensitive data.
The external hard drives are stored in a personal locker which can only be opened with a personal key. Furthermore, the BitLocker option is turned on, so the drive can only be unlocked with a password.

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

The Shared network drive (J: drive) comes at a price of 503.66 euro per TB/year. The available volume of storage is currently 200 GB, but can be increased if necessary.

The external hard drives are priced at around 85 euros/TB.
Costs are covered by the bench-fee.

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 will be preserved for 10 years according to KU Leuven RDM policy.

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

Data will be archived on the KU Leuven K drive.

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

The costs are estimated to be around 100 euro/TB/year. Costs are covered by the bench-fee.

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, …)

Data will be made available upon publication. Unpublished data can be requested at the PI (I. Vankelecom).

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

The PI is always able to access the data, and can be requested at PI.

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.

FRIS, KU Leuven RDR

When will the data be made available?

Upon completion of the project, or when results are published in paper.

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

Creative Commons Attribution license.

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?

FRIS is free. KU Leuven RDR free for 50 GB.

6. Responsibilities

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

PhD researcher Scout Caspers

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

IT support at KU Leuven.

Who will manage data preservation and sharing?

PI Ivo Vankelecom

Who will update and implement this DMP?

PhD researcher Scout Caspers