EXPLORING ULTRA-HIGH-PERFORMANCE ZEOLITE-FILLED MEMBRANES FOR GAS AND LIQUID SEPARATIONS

A Data Management Plan created using DMPonline.be

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Project abstract:

An ultra-high performance zeolite-filled mixed matrix membrane (MMM) was published in “Science” by the applicant recently. This novel membrane integrates excellent selectivity/permeability performance, robustness, anti-aging, moisture-resistance, easy-processing and handling properties in one single material, and outperforms all reported membranes by orders of magnitude. This MMM platform exhibits tunable and unprecedented performance for valuable and energy-intensive gas separations, such as CO2/CH4, CO2/N2 separations for natural gas/biogas purification and flue-gas treatment, N2/hydrocarbons separation for hydrocarbon recovery, H2/CH4 separations for hydrogen production. Based on these breakthroughs, the applicant aims to further develop a novel thin-film nanocomposite membrane (TFN) which consists of an ultra-permeable, selective zeolite-filled MMM top-layer supported by a flexible polymeric substrate and extend this membrane platform to various critical liquid and gas separations. Ultimately, a roll-to-roll membrane preparation strategy will be developed to scale up the advanced TFN, hence ready for industrial applications

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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.

Dataset name / ID	Description	New or reuse	Digital or Physical data	Data Type	File format	Data volume	Physical volume
		*Indicate: **N**(ew data) or **E**(xisting data)*	Indicate: **D**(igital) or **P**(hysical)	Indicate: **A**udiovisual **I**mages **S**ound **N**umerical **T**extual **M**odel **SO**ftware Other (specify)		Indicate: <1GB <100GB <1TB <5TB >5TB NA	
Lab book notes	Observations and description of the practical execution of experiments	***N***	***P***	***T***	/	/	+/- 3 books
Experimental	Description of the experimental procedures used to execute the experiments (including membrane synthesis parameters, description of the used materials,...)	***N***	***D***	***T***	.docx	<1GB	/
Microscopy images	SEM, TEM, AFM and other microscopy images	***N***	***D***	***I***	.tif	<100GB	/
HTGS resuls	Results of high-throughput gas separation experiments	***N***	***D***	***N***	.xlsx	<100GB	/
TGA and DSC data	Output of thermogravimetric analysis and differential scanning calorimetry experiments	***N***	***D***	***N***	.xlsx	<100GB	/
IR spectra	Results of Fourier-transform and Raman infrared spectroscopy experiments	***N***	***D***	***N***	.xlsx	<100GB	/
UV-vis	Results of UV-vis spectroscopy	***N***	***D***	***N***	.xlsx	<100GB	/
XRD	Results of X-ray diffraction analysis	***N***	***D***	***N***	.xlsx	<100GB	/
PALS	Positron annihilation lifetime spectroscopy	***N***	***D***	***N***	.xlsx	<100GB	/
Visometry	Results of viscosity measurements	***N***	***D***	***N***	.xlsx	<100GB	/
TEA	Results of the techno-economic analysis	***N***	***D***	***N***	.xlsx	<100GB	/
Literature	Scientific papers, reviews,...	***E***	***D***	***T***	.pdf	<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:

N.A.

Are there any ethical issues concerning the creation and/or use of the data (e.g. experiments on humans or animals, dual use)? If so, refer to specific datasets or data types when appropriate and provide the relevant ethical approval number.

- No

Will you process personal data? If so, please refer to specific datasets or data types when appropriate and provide the KU Leuven or UZ Leuven privacy register number (G or S number).

- 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.

- Yes

New membrane synthesis conditions or membrane chemistries/compositions could prove valuable to patent for the desired application. Here, the protocols for preparing these materials will be patented before sharing the data.

Do existing 3rd party agreements restrict exploitation or dissemination of the data you (re)use (e.g. Material or 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

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).

Data is linked to experimental sections (word files), which describe how the data is generated and processed. These files are linked to the corresponding data files via an index file (excel file).

Will a metadata standard be used to make it easier to find and reuse the data?
If so, please specify which metadata standard will be used.

If not, please specify which metadata will be created to make the data easier to find and reuse.

- No

An excel file will be provided, which links each data file to the purpose, the experiment which generated it and the place where it is stored.

Data Storage & Back-up during the Research Project

Where will the data be stored?

- Large Volume Storage

- OneDrive (KU Leuven)

All project data will always be saved in (Shared) OneDrive folders.
These folders will be backed-up every 3 months on the Archive drive K

How will the data be backed up?

- Personal back-ups I make (specify below)

The back-ups are organized internally in the research group for all data.

Is there currently sufficient storage & backup capacity during the project?

If no or insufficient storage or backup capacities are available, 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?

The lab notes and work laptop are stored in a locked cupboard in the researcher's office. The office is located in a badge-restricted area of the building, and is locked if no one is inside.
The laptop is secured with a password and access to double authentication is required to access the KUL One Drive system from other devices.
No very sensitive data will be generated, therefore no extra security (encryption of the computer) is foreseen at this stage.

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

The internal storage costs are estimated to be 50 euro per TB for backup on the internal severs. OneDrive is provided by KU Leuven for free.

Data Preservation after the end of the Research Project

Which data will be retained for 10 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)?

- Large Volume Storage (longterm for large volumes)

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

The costs for long term data storage are 50 euro per TB per year.

Data Sharing and Reuse

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

- Yes, as restricted data (upon approval, or institutional access only)

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

All researchers and PI will have access at all time to the data. Externals can get access to the data upon approval of the 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 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.

- KU Leuven RDR (Research Data Repository)

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 Transfer Agreement (restricted data)

Do you intend to add a persistent identifier (PID) to your dataset(s), e.g. a DOI or accession number? If already available, please provide it here.

- No

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

KU Leuven RDR free for 50 GB, this should cover the total amount of data generated during this project.

Responsibilities

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

Xiaoyu Tan

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

Laurens Rutgeerts

Who will manage data preservation and sharing?

Laurens Rutgeerts
Annelies Vanvlasselaer

Who will update and implement this DMP?

Xiaoyu Tan