Exploring nano- and microstructures in advanced coated concrete for improved building thermal efficiency

A Data Management Plan created using DMPonline.be

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Project abstract:

Up to 4% of the deaths in the largest cities in Belgium are already attributed to the effect of heat during the more frequent climate extremes caused by global warming. Improving the thermal efficiency of buildings offers a solution to be better prepared for extreme temperature events. The overall aim of the project is to establish the fundamental relationships between the micro- and nanostructures and composition of synthesized novel energy-efficient concrete and multifunctional thermochromic coating and their material properties.
The specific objectives are: (i) to develop a new low-carbon concrete with reduced thermal conductivity and evaluate and model its material properties, (ii) to develop a multifunctional thermochromic coating for the building envelope, (iii) to model the impact of the concrete's surface moisture, surface profile and weather conditions on the adhesion of the coating, (iv) to develop a methodology to measure, test and validate the thermal efficiency of the developed coated concrete system. The project will thus generate the fundamental insight to achieve a building system with reduced heat transfer by both radiation and conduction.

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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.

Dataset Name	Description	New or reused	Digital or Physical	Only for digital data Digital Data Type	Only for digital data Digital Data format	Only for digital data Digital data volume (MB/GB/TB)	Only for physical data 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, .cvs,.pdf, .txt, .rtf, .dwg, .gml, … • NA	*Please choose from the following options:* • <100MB • <1GB • <100GB • <1TB • <5TB • <10TB • <50TB • >50TB • NA	
CON-S	Concrete synthesis protocol	New	Digital	Experimental	pdf	<1GB	
CON-C	Concrete characterization results	New	Digital	Experimental	xlsx	<1GB	
CON-I	Concrete characterization with SEM	New	Digital	Experimental	pdf	<100GB	
CON-M	Concrete characterization with micro-CT	New	Digital	Experimental	pdf	<1TB	
CON-P	Concrete prototype with coating	New	Physical	Other, prototype			decimeter size
COA-S	Coating synthesis protocol	New	Digital	Experimental	pdf	<1GB	
COA-C	Coating characterization results	New	Digital	Experimental	xlsx	<1GB	
COA-I	Coating characterization with SEM	New	Digital	Experimental	pdf	<100GB	
ADH-C	Adhesion characterization	New	Digital	Experimental	xlsx	<1GB	
ADH-M	Adhesion modeling results	New	Digital	Simulation data	pdf	<1GB	
INS-S	Insulation measurement set-up	New	Physical	Other, equipment set-up prototype			decimeter size
INS-C	Insulation characterization	New	Digital	Experimental	xlsx, csv, json	<1GB	

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:

No existing data will be reused in this project.

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.

- Yes

We will make a new type of concrete and a new type of advanced thermochromic coating. The research is on a fundamental level, but it does have an economic impact. The project aims to develop a new integrated thermochromic coated concrete material prototype within a laboratory setting. Only in a follow-up study, the prototype can be further developed towards a product or technology at higher TRL, which can then be licensed to companies.
The datasets associated with potential commercial valorization involve:
- CON-S: Concrete synthesis protocol
- CON-P: Coated concrete prototype
- COA-S: Coating synthesis protocol

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).

For each of the characterization analyses, the measurement procedures and conditions, instrument type, settings, etc will be recorded in text documents.
We will add the following metadata for the datasets:
- CON-S: details on investigation, investigator, topic and keyword, publication, dataset, datafile, parameters, authorization
- CON-C: details on investigation, investigator, topic and keyword, publication, materials, dataset, datafile, parameters, authorization
- CON-I: details on investigation, investigator, topic and keyword, publication, materials, dataset, datafile, parameters, authorization
- CON-M: details on investigation, investigator, topic and keyword, publication, model, dataset, datafile, parameters, authorization
- CON-P: details on investigation, investigator, topic and keyword, publication, materials, dataset, datafile, parameters, authorization
- COA-S: details on investigation, investigator, topic and keyword, publication, dataset, datafile, parameters, authorization
- COA-C: details on investigation, investigator, topic and keyword, publication, materials, dataset, datafile, parameters, authorization
- COA-I: details on investigation, investigator, topic and keyword, publication, materials, dataset, datafile, parameters, authorization
- ADH-C: details on investigation, investigator, topic and keyword, publication, materials, dataset, datafile, parameters, authorization
- ADH-M: details on investigation, investigator, topic and keyword, publication, materials, dataset, datafile, parameters, authorization
- INS-S: details on investigation, investigator, topic and keyword, publication, dataset, datafile, parameters, authorization
- INS-C: details on investigation, investigator, topic and keyword, publication, dataset, datafile, parameters, authorization

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

We will use the RDR data repository of KU Leuven. A metadata standard is automatically applied upon depositing the data. The metadata model will include fields that are required, recommended and optional. Using this data repository, the data sets will be findable and reusable.

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

Where will the data be stored?

OneDrive at KU Leuven
We will also explore novel solution for data storage, such as Active Data Management Platform (ManGO platform of KU Leuven)

How will the data be backed up?

The data storage facilities are automatically backed up by KU Leuven ICTS

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

We will use the storage facilitities of KU Leuven ICTS. We have foreseen budget to acquire enough storage for the project. The amount of storage can always be extended in the course of the project.

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

KU Leuven has IT specifications for data storage and management. Based on the confidentiality of the data, storage space, possibility to share data with colleagues, type of data, metadata, etc, IT provides tailored solutions. The recommended storage is SharePoint on premise or online site of Teams site. Only the persons involved in the project will be able to access the data. If other (third party) persons or research groups are interested in the data, then we will discuss this among the promotors of the project. Large volume data will be stored on the dedicated platform of the KU Leuven (LVD storage @ drives.kuleuven.be)

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

No extra costs. The platform of Sharepoint, Teams of the Active Data Management Platform is offered free of charge by KU Leuven.

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)?

KU Leuven RDR

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

Free for KU Leuven staff

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, ...)

Some data can be important in terms of potential further commercial valorization, and therefore, need to be kept confidential, and thus no access until patent is issued and granted if applicable.

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

The data will be restricted/embargoed until the work is published or patented. Only the specific investigators involved in the research project will have access to the data during the restriction / embargo period.

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

Some data may be used for patent application afterwards, and in this way, they would be restricted temporarily.

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, or for some data, after patenting

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

CC-BY 4.0 (data)

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?

The mentioned storage types are free for staff at KU Leuven

6. Responsibilities

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

The PhD researchers working on the research project and generating the data will make the dataset files along with the metadata. They will ensure uploading and storing the datasets during the course of their PhD and the project.

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

The PhD researchers working on the research project will take care of data storage and backup during the research project, and they will be supervised in this task by the promotors of the research project.

Who will manage data preservation and sharing?

The promotors of the research project will be responsible for the long term data storage, preservation and sharing of data. Specifically, this will be Prof. Vandeginste for COA-S, COA-C, COA-I and INS-S, INS-C, and Prof Li for datasets CN-S, CON-C, CON-I, CON-M, CON-P and ADH-C, ADH-M.

Who will update and implement this DMP?

The promotors of the research project will update this DMP and make sure it is implemented.

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GDPR

GDPR

Have you registered personal data processing activities for this project?

* No

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DPIA

DPIA

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

- Not applicable