Nanoscale plastic deformation and residual stress in metals due to surface polishing

A Data Management Plan created using DMPonline.be

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

Template: FWO DMP (Flemish Standard DMP)

Principal Investigator: Joris Everaerts

Grant number / URL: G091823N

ID: 199488

Start date: 31-12-2022

End date: 30-12-2026

Project abstract:

Mechanical polishing is commonly used for both surface finishing and metallographic sample preparation for a broad range of materials. In metals, however, polishing leads to the formation of a modified surface layer due to plastic deformation, which also induces subsurface residual stress. This has an impact on many material properties and on characterization techniques that rely on surface measurements. There has not yet been a systematic study to investigate the effect of polishing and material parameters on this surface alteration, nor the possible variations between grains or phases. We will examine these phenomena quantitatively for a strategic range of metallic specimens, using novel nanoscale surface analysis techniques. An unconventional polishing approach will be followed, starting from pristine electropolished surfaces prior to mechanical polishing, in order to determine the impact of individual polishing parameters. The influence of material properties will be clarified systematically by examining pure metals with inherently different hardness, by modifying the grain size and probing individual grains, and by examining specific alloys.

This will result in fundamental insights regarding surface layer modifications in metals due to polishing, which will serve as a basis for a wide array of future research.

Last modified: 24-05-2023

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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	
Microstructural characterization	Optical & electron microscopy images	New	Digital	Experimental	.tif	<1GB	
EBSD analysis	Characterization of crystallographic textures	New	Digital	Experimental	EDAX ascii (.ang) and binary (.osc) files	<100GB	
FIB-DIC experiments	Sequential images (electron microscopy) for DIC analysis - 200-400 images per measurement	New	Digital	Experimental	.tif	<1TB	
Nanoindentation experiments	Property mapping via nanoindentation (load-displacement data)	New	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).

A readme.txt file will be created for each dataset described above.

- Microstructural characterization: unique sample ID's with accompanying information on heat treatment details (time, temperature) & polishing details (all parameters, products)
- EBSD data: reference to required software package (EDAX OIM Analysis)
- FIB-DIC experiments: readme.txt to provide detailed description of analysis steps, ref. to open source DIC code & matlab code (.m file)
- Nanoindentation: metadata included in .txt files describe indentation parameters

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?

Data will be stored safely on both personal laptop & computer hard drives and on the KU Leuven internal servers (central storage facility with automated backup).

How will the data be backed up?

All data will be backed-up regularly and stored safely on physical external hard drives and on Microsoft OneDrive , which is a cloud-based server supported by KU Leuven.

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

Total anticipated size of all data in the project: <2TB
OneDrive: limit 2TB
Internal KUL storage: no hard limit

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

All data and model source codes will be handled in accordance with the IT guidelines - all computers and external drives will be password protected. Security upgrades are constantly performed by the IT staff. While sharing the datasets, read-only permissions will be applied. Internal KUL storage is highly secured (incl. data-at-rest-encryption).

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

We do not foresee any additional data storage or backup costs other than the operational costs of the IT of our department.

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 retained for at least 10 years after the end of the project according to KU Leuven RDM policy.

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

Data linked directly to publications will be uploaded to a research data repository (either the repositories of the respective journals, or KU Leuven's own RDR system).
All data will be stored and curated on the PI's KU Leuven network drive (central storage facility with automated backup).

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

We do not foresee any additional data storage or backup costs other than the operational costs of the IT of our department.

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 an Open Access repository

Data linked directly to publications will be uploaded to a research data repository (either the repositories of the respective journals, or KU Leuven's own RDR system).

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

NA

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.

KU Leuven RDR
https://www.kuleuven.be/rdm/en/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.

CC-BY-NC-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.

- Yes

Data uploaded to the KU Leuven RDR will get a DOI that can be used to cite the data.

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

We do not foresee any additional data sharing costs due to the expectedly limited size of published data sets.

6. Responsibilities

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

Ph.D. researcher (Kento Takahashi)

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

Ph.D. researcher (Kento Takahashi)

Who will manage data preservation and sharing?

PI (Joris Everaerts)

Who will update and implement this DMP?

PI (Joris Everaerts)

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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)

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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DPIA

DPIA

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

* Not applicable

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GDPR

Have you registered personal data processing activities for this project?

* Not applicable

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