# Plan Overview

*A Data Management Plan created using DMPonline.be*

**Title:** Titanium alloys with tailored thermal expansion (TITREX)

**Creator:** Matthias Bönisch

**Principal Investigator:** Matthias Bönisch, n.n., Nele Moelans

**Affiliation:** KU Leuven (KUL)

**Template:** KU Leuven BOF-IOF

**Principal Investigator:** Matthias Bönisch, n.n. n.n., Nele Moelans

**Project abstract:**

This project researches and develops innovative materials with tailor-made thermal expansion based on martensitic titanium alloys. The use of martensitic alloys is a recent innovative, but widely unexplored approach in this regard. In contrast to conventional ceramic and metallic materials for thermal expansion management, the expansion behavior of martensitic titanium alloys can be controlled in a wide range by adjusting alloy content, phase composition and crystallographic texture. This project combines experiments with simulations, while material-wise, it focuses on α''-forming titanium alloys, exhibiting strongly anisotropic and exceptionally large (linear) thermal expansion. The latter offers the prospect of targeted, application-specific customization of thermal expansion via thermoplastic processing and heat treatment.

**ID:** 213323

**Start date:** 01-10-2024

**End date:** 30-09-2028

**Last modified:** 31-03-2025

# Titanium alloys with tailored thermal expansion (TITREX)

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 | |
| Ti alloy samples | Samples of various Ti alloys in various processing states | N | P | | | | 500 pieces (~60 L) |
| ICP-OES, CGHE, EDX compositional analysis | Information on local and global chemical composition | N | D | N, I | .csv/.xlsx .docx .tiff/.jpg | <1GB | |
| DSC | Differential scanning calorimetry datasets | N | D | N | .csv/.txt | <100MB | |
| Dilatometry/TMA | Dilatometry/TMA datasets | N | D | N | .csv/.txt | <100MB | |
| Light microscopy | Light microscopy images | N | D | I | .tiff/.jpg | <5GB | |
| SEM | Scanning electron microscopy images | N | D | I | .tiff/.jpg | <500GB | |
| EBSD | Electron backscattering diffraction maps of grain orientation with/without original patterns | N | D | I | proprietary format of EBSD system .tiff/jpg | <5TB | |
| TEM | Transmission electron microscopy datasets (ex-situ, in-situ) | N | D | I | .tiff/jpg | <300GB | |
| XRD | X-ray diffraction datasets (phase analysis, lattice thermal expansion, texture, strain, Matlab/MTEX codes) | N | D | N | .csv/.txt .m | <3GB | |
| HEXRD | High-energy X-ray diffraction datasets from synchrotron beamtimes incl. analysis scripts | N | D | I, N | .tiff/.txt .hdf5 .py/.ipynb | <5TB | |
| Mechanical testing | Data of mechanical tests (uniaxial tension and compression, at different temperatures, thermal stress, work output) | N | D | N | .csv/.txt | <200MB | |
| Calphad | Thermodynamic calculations using Thermocalc | N | D | N,I | .xlsx, .png | <10GB | |
| Phase field model | Matlab codes of the phase field model | N | D | SO | .m | <200MB | |
| Phase field simulations | Simulation results from the phase field model | N | D | N | .txt/.mat | <300GB | |
| Powerpoint presentations | Progress presentations; slides, posters for group meetings/conferences... | N | D | Other | .pptx/.pdf | <2GB | |
| Manuscripts | Manuscripts for journal publications/proceedings | N | D | T, I | .docx/.pdf | <2GB | |

**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.

- No

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).

- all experiments, procedures and methodologies will be digitally documented
- all data generated from experiments and simulations will be labelled, described and contextualized
- all raw data will contain metadata detailing parameters and measurement conditions; missing native metadata will be manually added in readme files
- all processed data will be labeled for tracability back to its raw data
- source codes will be documented and commented
- simulation results will be accompanied with readme-files explaining how the simulations were configured
- data will be saved into folders corresponding to dataset, with filenames corresponding to sample names, and if necessary, a spreadsheet will also be used to write down further sample/simulation-specific details; the same approach will be used for processed data

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

Metadata will be included into the readme file described above. Filenames can then be used to find data.

**Data Storage & Back-up during the Research Project**

**Where will the data be stored?**

- Personal network drive (I-drive)
- Other (specify below)

- personal KU Leuven OneDrive
- external hard drives for the largest datasets (raw HEXRD, EBSD data)

**How will the data be backed up?**

- Personal back-ups I make (specify below)
- Standard back-up provided by KU Leuven ICTS for my storage solution

- external hard drives will be backed up with a copy

**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.**

- No (explain solution below)
- We will purchase external hard drives for the raw HEXRD/EBSD datasets at need
- If more storage space is needed on the KUL servers, we will purchase Large Volume Storage

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

- OneDrive and I drives are only accessible by the owner by default
- external hard drives are kept in locked offices or drawers

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

The current yearly cost per TB Large Volume Storage is € 95.14, which will be covered by consumable budget of this project if needed.

**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)?

- Other (specify below)
- Large Volume Storage (longterm for large volumes)

- external hard drives for the largest datasets (raw HEXRD, EBSD data)

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

~ € 100 / year; will be covered by future projects

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.

Project member will be able to access the data.
Future collaborators can be given access to selected datasets.

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.**

- Yes, a PID will be added upon deposit in a data repository

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

No costs are expected.

**Responsibilities**

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

The researchers are resonsible for structuring and documenting their data. The three (co-)promotors will supervise the documentation.

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

The researchers, supervised by the 3 (co-)promotors of this project.

**Who will manage data preservation and sharing?**

The three (co-)promotors of this project.

**Who will update and implement this DMP?**

The project promotor together with the two co-promotors of this project.