The research data management practices described in this README were developed in accordance with the *Research Data Management Plan Handbook: Guidelines for Developing a Research Data Management Plan* (Tas et al., 2026) for CRC 1615 *SMART Reactors for Future Process Engineering*. The handbook provides the underlying framework for documenting, organizing, preserving, and publishing research data in alignment with the FAIR principles and the research data management requirements of the German Research Foundation (DFG). [1]

Project Title: DFG Collaborative Research Center CRC 1615 "SMART Reactors for Future Process Engineering", sub-project C01 "Integration of components into adaptive geometries".

Related Publication: [Insert the full citation and DOI of the related publication.]

Principal Investigators / Authors:

Jan Hünting[1], ORCID 0009-0000-7484-4992

Kathrin Marina Eckert[2,3], ORCID 0000-0002-8454-4886

Jelle Jacobs[1], ORCID 0009-0007-6893-1281

Maria Isabelle Maiwald[1], ORCID 0000-0001-9719-8057

Dirk Herzog[1,4], ORCID 0000-0001-7059-6151

Irina Smirnova[2,3], ORCID 0000-0003-4503-4039

Michael Schlüter[5], ORCID 0000-0001-5969-2150

Ingomar Kelbassa[1,4], ORCID 0009-0003-1325-4472

[1]Institute for Industrialization of Smart Materials (ISM), Hamburg University of Technology (TUHH), Harburger Schloßstraße 28, 21079 Hamburg, Germany

[2]Institute of Thermal Separation Processes (TVT), Hamburg University of Technology (TUHH), Eißendorfer Straße 38, 21073 Hamburg, Germany

[3]United Nations University Hub on Engineering to Face Climate Change at the Hamburg University of Technology, United Nations University Institute for Water, Environment and Health (UNU-INWEH), Hamburg, Germany

[4]Fraunhofer Research Institution for Additive Manufacturing Technologies (IAPT), Am Schleusengraben 14, 21029 Hamburg, Germany

[5]Institute of Multiphase Flows (IMS), Hamburg University of Technology (TUHH), Eißendorfer Straße 38, 21073 Hamburg, Germany

[1] Tas, E., Ruprecht, D., & Knopp, T. (2026). Research Data Management Plan Handbook CRC 1615 (Version V3). Zenodo. https://doi.org/10.5281/zenodo.21126620

Funding Acknowledgement:

This data set was generated as part of the DFG-funded project *CRC 1615: SMART Reactors for Future Process Engineering* (DFG Project Number: 503850735).

1. General Information

Data set Title: Supplementary material to publication with title: Additive Manufacturing of Hydrogel-Polymer Combinations for Applications in Smart Reactors

Short Description: This data set contains supplementary material to the publication with the title: "Additive Manufacturing of Hydrogel-Polymer Combinations for Applications in Smart Reactors". The files include Excel tables, a MATLAB script, a python script, all relevant results, additional pictures and plots

Date of Data Collection: 2026

Geographical Coverage: Hamburg, Germany

Keywords: Additive Manufacturing, Material Extrusion, Hydrogels, Polymers, Multi-material, Smart Reactors

2. Methodological Information

Data Collection and Processing: See related publication

3. Data and File Overview

List of Files and Structure:

The content of the data set is listed below in the same order as the files are stored in the folder *Supplementary_Data.zip*. Files are highlighted with bold font and a short description is given.

- **ReadMe_Supplementary-Dataset.pdf**: This readme file
- Supplementary-Dataset.zip
  - Hydrogel Design of Experiments
    - **Hydrogel_DoE_results.xlsx**: Excel table containing all DoE design points, measured results, and coefficients of determination
    - **Main-effect_charts.pdf**: PDF containing main-effect charts for HG_{hwc} and HG_{lwc}
    - **Standardized_Pareto_charts.pdf**: PDF containing standardized Pareto charts for HG_{hwc} and HG_{lwc}
  - Hydrogel Formulations

        - **HGlwc_crystallized_threads_1.jpg**: Image of crystallized threads in HG_{lwc} precursor
        - **HGlwc_crystallized_threads_2.jpg**: Image of crystallized threads in HG_{lwc} precursor
        - **Hydrogel-formulations.xlsx**: Excel table containing the constituents of all hydrogel formulations used in the related paper (absolute quantities and weight percentages)
    - Shrinkage Behavior
        - **Shrinkage_behavior_Bar-chart.png**: Image showing bar chart of mass-based shrinkage
        - **Shrinkage_behavior_results.xlsx**: Excel table containing all measured results of the shrinkage behavior experiment
        - **Shrinkage_behavior_Water-bath.jpg**: Image of shrinkage behavior samples submerged in water
    - Shrinkage Kinetics
        - **Shrinkage_kinetics_Camera-setup.jpg**: Image showing camera setup of shrinkage kinetics experiment
        - **Shrinkage_kinetics_Image-software.jpg**: Image showing image acquisition software of shrinkage kinetics experiment
        - **Shrinkage_kinetics_Mold-printing.jpg**: Image showing printing of the mold for the shrinkage kinetics samples
        - **Shrinkage_kinetics_Normalized-volume-chart.png**: Image of chart showing normalized volume over time from shrinkage kinetics experiments
        - **Shrinkage_kinetics_Python-code.py**: Python code for the analysis of the shrinkage kinetics experiment (calculating normalized volume change)
        - **Shrinkage_kinetics_Sample-positioning.jpg**: Image of positioned shrinkage kinetics samples in glass vessel
    - Shrinkage-induced Bending of Multi-material Plates
        - Bilayer_bending_Pictures
            - After_fabrication
                - **Bilayer_bending_After-Fabrication_All-Samples.jpg**: Image of all six multi-material bilayer bending samples after fabrication
            - Fully_shrunken
                - **Bilayer_bending_Fully-shrunken_Sample1.jpg**: Image of multi-material bilayer bending sample 1 in the fully shrunken state
                - **Bilayer_bending_Fully-shrunken_Sample2.jpg**: Image of multi-material bilayer bending sample 2 in the fully shrunken state
                - **Bilayer_bending_Fully-shrunken_Sample3.jpg**: Image of multi-material bilayer bending sample 3 in the fully shrunken state
                - **Bilayer_bending_Fully-shrunken_Sample4.jpg**: Image of multi-material bilayer bending sample 4 in the fully shrunken state
                - **Bilayer_bending_Fully-shrunken_Sample5.jpg**: Image of multi-material bilayer bending sample 5 in the fully shrunken state

        - **Bilayer_bending_Fully-shrunken_Sample6.jpg**: Image of multi-material bilayer bending sample 6 in the fully shrunken state
    - Initally_swollen
        - **Bilayer_bending_Initially-swollen_Sample1.jpg**: Image of multi-material bilayer bending sample 1 in the initially swollen state
        - **Bilayer_bending_Initially-swollen_Sample2.jpg**: Image of multi-material bilayer bending sample 2 in the initially swollen state
        - **Bilayer_bending_Initially-swollen_Sample3.jpg**: Image of multi-material bilayer bending sample 3 in the initially swollen state
        - **Bilayer_bending_Initially-swollen_Sample4.jpg**: Image of multi-material bilayer bending sample 4 in the initially swollen state
        - **Bilayer_bending_Initially-swollen_Sample5.jpg**: Image of multi-material bilayer bending sample 5 in the initially swollen state
        - **Bilayer_bending_Initially-swollen_Sample6.jpg**: Image of multi-material bilayer bending sample 6 in the initially swollen state
- **Bilayer_bending_CAD_TPU-base-plate.jpg**: Image of CAD file of bilayer bending TPU base plate
- **Bilayer_bending_Change-curvature-chart.png**: Image of bar chart showing change in curvature of six multi-material bilayer bending samples
- **Bilayer_bending_MATLAB-Script_Circle-fit.m**: MATLAB code for the analysis of the multi-material bilayer bending experiment (curvature magnitude calculation)
- **Bilayer_beding_results.xlsx**: Excel table containing all measured and calculated results of the multi-material bilayer bending experiment
- **Bilayer_bending_Signed-curvature_chart.png**: Image of bar chart showing signed curvature of six multi-material bilayer bending samples for in swollen and shrunken state

4. Access and Licensing Information

Repository and Persistent Identifier: TUHH Open Research repository TORE (www.tore.tuhh.de) at https://hdl.handle.net/11420/64461 (DOI: 10.15480/882.18028)

License for Use: The data is made available under the Attribution 4.0 International (CC BY 4.0) License: https://creativecommons.org/licenses/by/4.0/

Access Restrictions: -

Text for Citation: J. Hünting, “Supplementary material to publication with title: Additive Manufacturing of Hydrogel-Polymer Combinations for Applications in Smart Reactors.” www.tore.tuhh.de. doi: 10.15480/882.18028

5. Software Dependencies

Software Required: Excel 2019, Word 2019, Python 3.11, MATLAB R2019a, PDF-viewer, Image-viewer

6. Ethical and Legal Aspects

Data Protection: -

Consent Statement: [Indicate whether participants consented to data sharing.]

7. Versioning and Updates

Version Number: v1.0

Date of Release: [YYYY-MM-DD]

Change Log: -

8. Contact Information

Corresponding Author:

Name:	Jan Hünting
Institution:	Institute for Industrialization of Smart Materials (ISM), Hamburg University of Technology (TUHH), Harburger Schloßstraße 28, 21079 Hamburg, Germany
E-mail:	jan.huenting@tuhh.de
ORCID:	0009-0000-7484-4992
Website:	https://www.tuhh.de/ism/willkommen