

Digital Transformation in Materials Science and Engineering: Advancing Ontologies through the German Initiatives Platform MaterialDigital (PMD) and NFDI-MatWerk

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Abstract

As part of Germany's digitalization program, two major collaborative initiatives were launched in the early 2020s to advance the digitization of material research in Germany. The Platform MaterialDigital (PMD), funded by the German Federal Ministry for Education and Research (BMBF), aims to digitize material research, enhancing efficiency, accelerating development, and improving research quality. Focused on industrial applications, it promotes standardized methods, interdisciplinary collaboration, and knowledge sharing [1]. This transformation seeks to position Germany as a leader in innovative material research by integrating digital tools and fostering practical, high-impact advancements. The National Research Data Infrastructure for Materials Science and Engineering (NFDI-MatWerk), also funded by the German Research Foundation (DFG), focuses on the integration and standardization of data from various sources, including both experimental and simulation data, as well as associated metadata [2]. This infrastructure is essential for supporting innovative research by providing the necessary tools and frameworks for efficient data management and long-term accessibility. Although several task areas are defined for both initiatives, one of the core focus areas in each project is developing materials science and engineering ontologies to standardize definitions, improve data integration, and foster greater collaboration across research disciplines. Following the ISO/IEC 21838-2 standard, the most recent versions of the PMD Core Ontology (PMDco) and MatWerk Ontology (MWO) utilize the Basic Formal Ontology (BFO) as the top-level ontology [3,4]. This talk will outline the scope and design of these ontologies, showcasing patterns and use cases for the semantic representation of materials science and engineering concepts.

References

[1] <https://www.materialdigital.de/>

[2] <https://nfdi-matwerk.de/>

[3] The PMD Core Ontology (PMDco) official release repository:

<https://github.com/materialdigital/core-ontology>

[4] Repository for developing the NFDI MatWerk ontology (MWO): <https://git.rwth-aachen.de/nfdi-matwerk/ta-oms/mwo>