

- **Unified semantic data model** integrating process, experiment, and simulation data.
- **FAIR-compliant infrastructure** providing systematic ontology-guided data access.
- **AI-supported assistant** enabling traceable, non-speculative interaction with heterogeneous datasets.
- **Web-based interface** for browsing, visualization, and simulation result rendering.

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 Further information about the DiMad Project (01.01.2023–31.12.2025) is available on the Plattform MaterialDigital website: <https://www.materialdigital.de/project/15>

Motivation

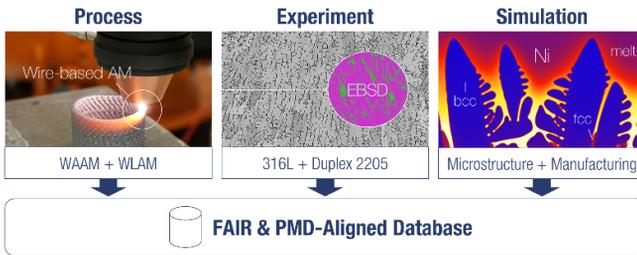
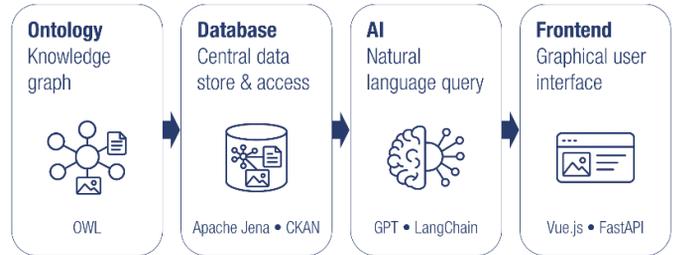


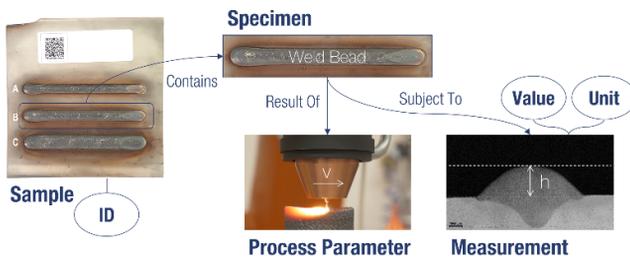
Illustration of the heterogeneous data generated in wire-based additive manufacturing, from process parameters and experimental characterization to simulation results, motivating the need for a unified, FAIR-oriented and PMD-aligned data infrastructure.

Architecture



Overview of the system architecture combining a semantic data model, central data storage, natural-language interaction, and a lightweight web frontend to provide integrated access to all data sources.

Domain Ontology



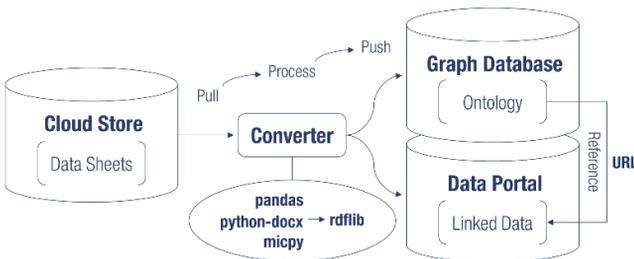
Partial view of the domain ontology, showing key entities and relations, including samples, specimens, process parameters, and measurements, enabling consistent linking and interpretation of data across experiments and simulations.

Web Frontend



Browser-based user interface offering structured navigation, visualization of process and measurement data, rendering of linked simulation fields, and an integrated chat view for AI-assisted interaction.

Integrated Database



Data ingestion and storage workflow, linking standardized project data sheets and simulation outputs to the semantic model and referencing large datasets as externally linked resources managed by an efficient data backend.

AI Assistant



Natural-language assistant that transforms user requests into a schema-guided reasoning process, ensuring reliable, traceable, and non-speculative access to the underlying dataset across all workflows.

A joint project by

