Semantic interoperability for a materials commons digital infrastructure

MaterialsCommons

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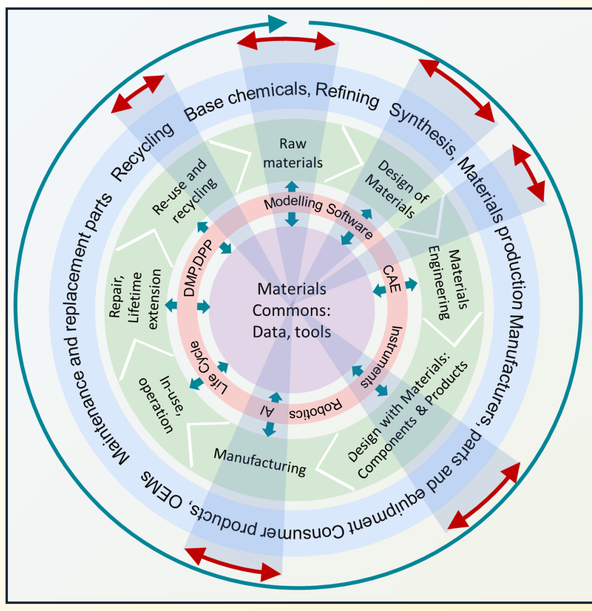
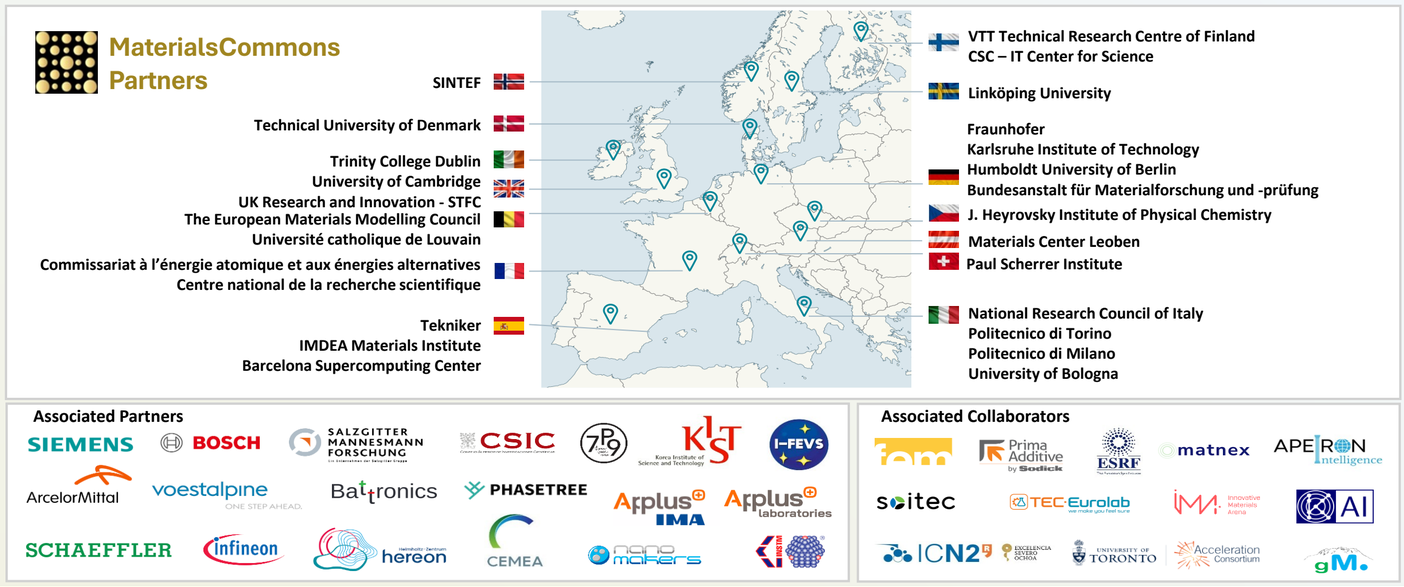
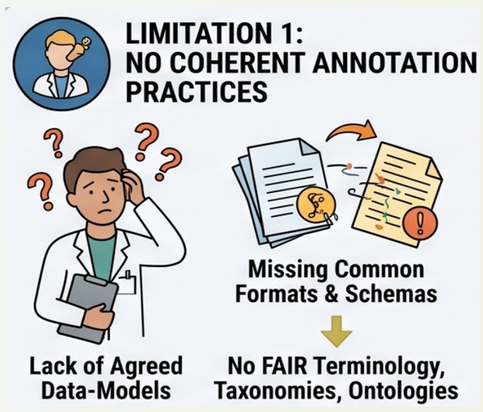
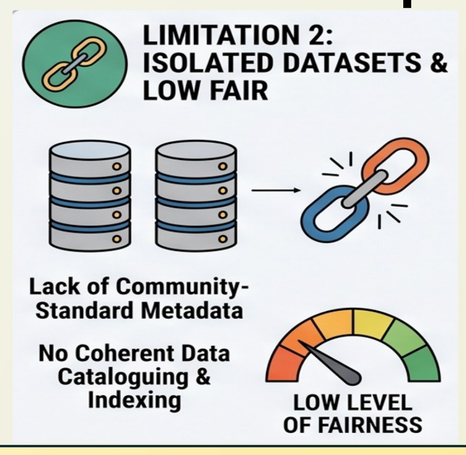


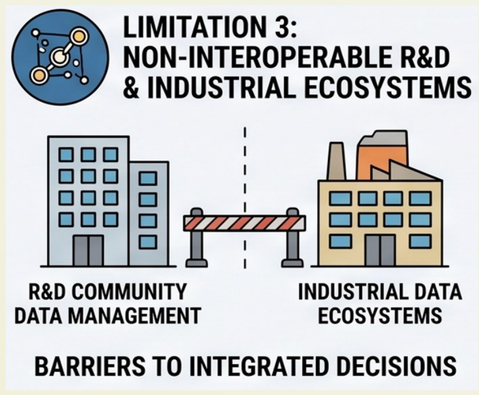
MaterialsCommons [1] is a European initiative to bring together shared digital resources, such as data and workflow tools and form a connected infrastructure across all stages of the life cycle that can be accessed through a single entry point.

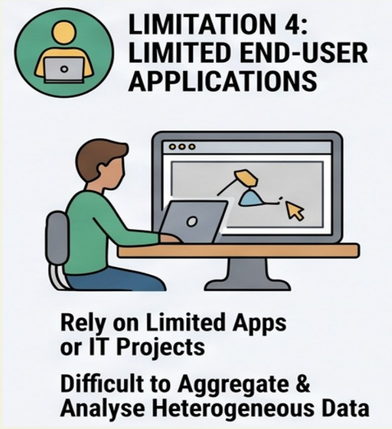


Semantic interoperability: current limitations

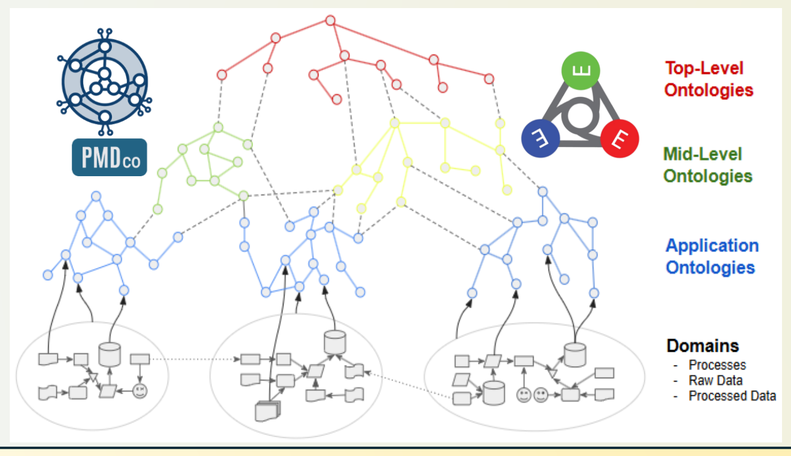


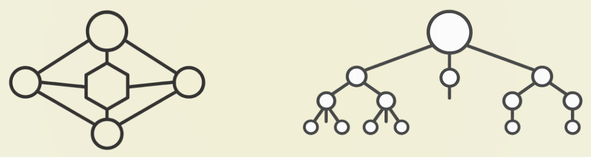






MaterialsCommons Semantic Foundation

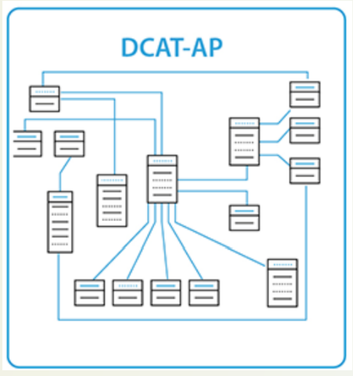




Semantic patterns and **taxonomies:** agnostic of top level ontology, but with implementations in EMMO [2] and PMDco [3] frameworks.

Schemas

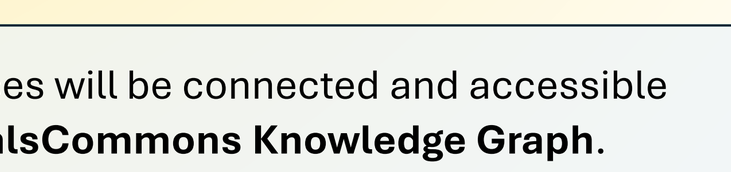
JSON-LD



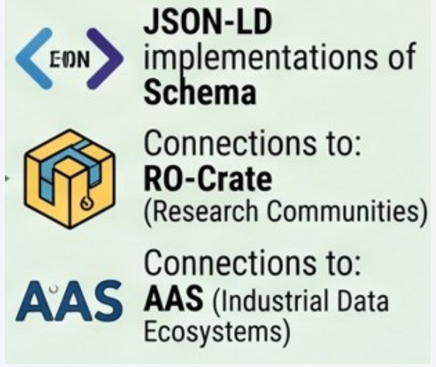
MaterialsDCAT-AP

The **MaterialsCommons Semantic Foundation** consists of a comprehensive, well-documented set of metadata schemas, taxonomies, ontologies, and **semantic patterns**. Tools for mapping semantic assets to data sources and applications will be developed, e.g. actionable linked data using JDON-LD implementations will be created. In order to support a standardised data cataloguing across different materials science domains, MaterialsCommons will develop **Materials DCAT-AP**, a DCAT application profile [4] for the field.

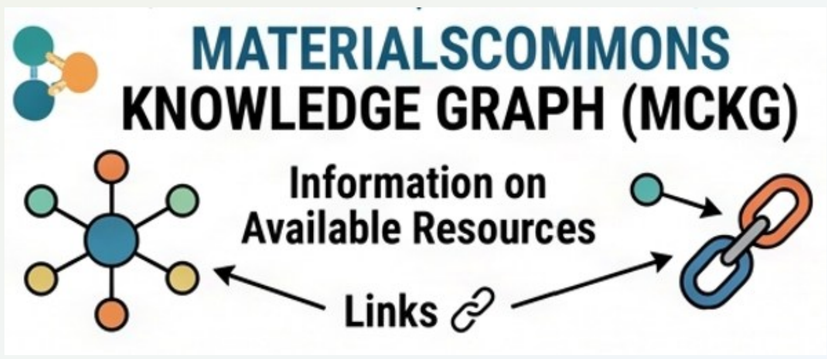
Semantic patterns are re-usable building blocks for common materials science concepts and workflows, such as the description of a process with input and output or of a measurement result as a quantity with value and units. While the semantic patterns are agnostic of top level ontology, MaterialsCommons will provide implementations within both the EMMO [2] and PMDco [3] frameworks. Semantic patterns support high-quality ontological modelling, ensure **consistency, clarity** in knowledge representation, **reusability, constraints** (e.g., via SHACL shapes), and enable **semantic scalability**.



Example of a semantic pattern for processes with input and output



All resources will be connected and accessible via**MaterialsCommons Knowledge Graph**.



References:

[1] MaterialsCommons project: https://www.materialscommons.eu/

[2] Elementary Multiperspective Material Ontology (EMMO): https://github.com/emmo-repo/EMMO

[3] PMD Core Ontology: https://github.com/materialdigital/core-ontology

[4] How to create your DCAT-AP profile: https://semiceu.github.io/DCAT-AP-reuse-guidelines/

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