Domain level ontology design: DISO and MDMC-PROV

How can a computer understand the relations of data or objects from the real world? Ontologies are semantic artifacts that capture knowledge about their domain of interest in a machine-understandable form. The main goal of developing ontologies is to formalize concepts and their relations through which humans express meaning and to use them as a communication interface to machines. Thus, ontology development is an important step towards generating linked and FAIR data.

Within HMC we support and co-develop domain and application-level ontologies. Here we present two developments: Dislocation Ontology (DISO) and Model and Data-Driven Materials Characterization Provenance (MDMC-PROV).

DISO: An important class of materials is crystalline materials, e.g., metals and semiconductors, which nearly always contain defects, the "dislocations". This type of defect determines many important material properties, e.g., strength and ductility. Over the past years, significant effort has been put into understanding dislocation behavior across different length scales via experimental characterization techniques and simulations. However, there is still a lack of common standards to formally describe and represent dislocations. Thus, in this work we develop the dislocation ontology (DISO), which is a domain ontology that defines the concepts and relationships related to linear defects in crystalline materials. DISO is published [1] through a persistent URL following W3C best practices for publishing Linked data.

MDMC-Prov: The rapid development of science and technology in everyday large data generation does not match the data understanding. These days, understanding how experiments are performed and results are derived become more complex due to a lack of provenance documentation. Therefore, the provenance must be tracked, described, and managed over the research process. Thus, in this work, we report an application ontology that can capture provenance information in materials science experiments. The ontology is based on the MDMC glossary [2], which defines the common terms in the materials science experiments. From each term, we map to PROV-O [3]. These ensure the validity, reproducibility, and reusability of the data.

[1] https://purls.helmholtz-metadaten.de/diso
[2] https://jl-mdmc-helmholtz.de
[3] https://www.w3.org/TR/2013/NOTE-prov-primer-20130430/

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Semantics

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Ontologies

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