

Ontology Development: Competency Questions

Ontology Team

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Innovations- Plattform MaterialDigital

Die Plattform für die Digitalisierung der Materialien

MATERIALDIGITAL

GEFÖRDERT VOM



Bundesministerium
für Bildung
und Forschung

Ein Verbundprojekt von:



Goal

- Guarantee **consistency** among use cases
- Guarantee **correctness**
- **Efficiency** of the development
- Support the **distributed development** of ontologies

Activities in the ontology development

1. Management activities
 - a. task identification
 - b. scheduling
 - c. control

2. Development activities
 - a. pre-development
 - b. development
 - c. post-development

3. Support activities

- **Tasks identification:**
 - definition of the activities
 - collecting and defining which resources are necessary
- **Scheduling**
- **Control:**
 - execution of tasks
 - guarantee the quality of the ontologies
 - producing documentation
 - managing of the software which will interact with the ontologies

Development Activities: pre-development

- Definition of **who/what** is going to use the ontology?
- Definition of **what characteristics** of the ontology are going to be used e.g., is reasoning necessary?
- **Feasibility** study: can an ontology be developed?

Development Activities: development

1. **Specification**: why is the ontology developed? What are the benefits? Who are the users?
2. **Conceptualization**: structuring the knowledge into a model answering to questions like: what are the classes? what are the needed concepts? how are the classes related to each other?
3. **Formalization**: transformation of the model into a computable model e.g., expressing the model in description logics
4. **Implementation**: construction of the ontology into a representation language such as OWL

Development Activities: post-development

- **Updates** and **adjustments** if necessary
- **Re-use** of the ontology in similar application scenario

Support Activities

- Gather knowledge from experts (knowledge acquisition)
- Integration with existing ontologies
- Evaluation
- Alignment

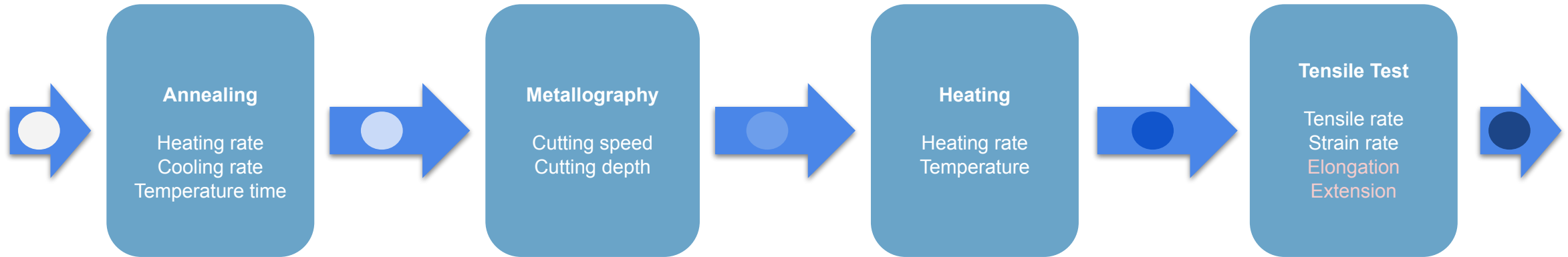
The Scope of an Ontology

- Which domain should be covered by the ontology?
- What should the ontology be used for?
- Who will use the ontology?
- What type of questions should be answered by the ontology?
- Formulation of competency questions
 - *What are the parameters that influence the yield stress?*
 - *What are the production parameters that a component made by a material X and a property Y has experienced within the PMD project?*
 - *Does the grain size of materials depend on the temperature set for the heating process?*

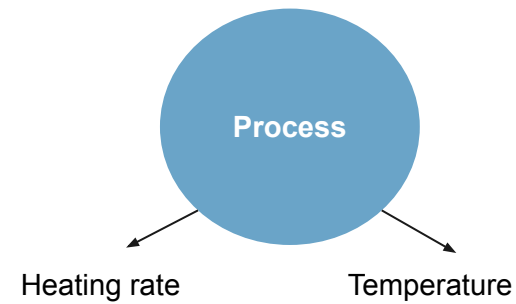
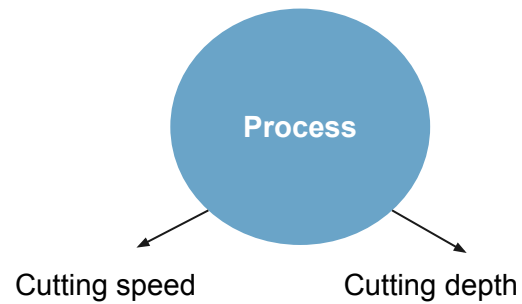
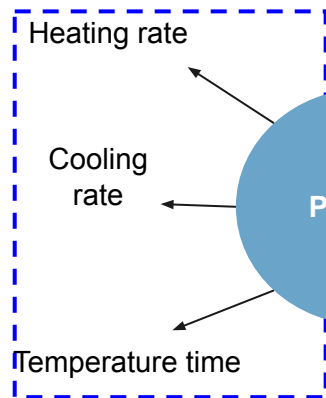
The structure of the modelling should reflect the knowledge which is necessary to exactly answer the competency questions

PMD Core Philosophy

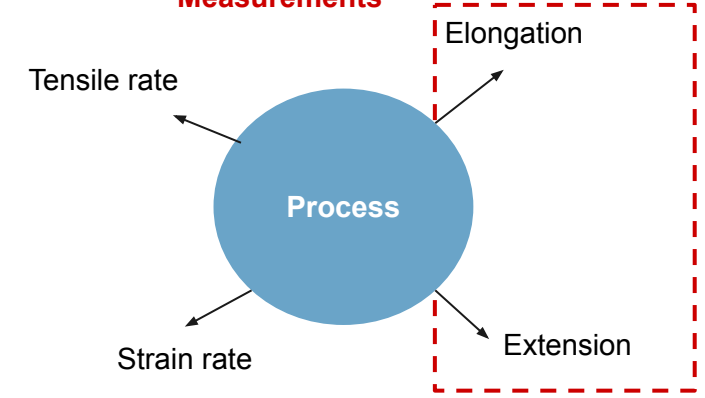
○ = an object that undergoes a process




Process parameters

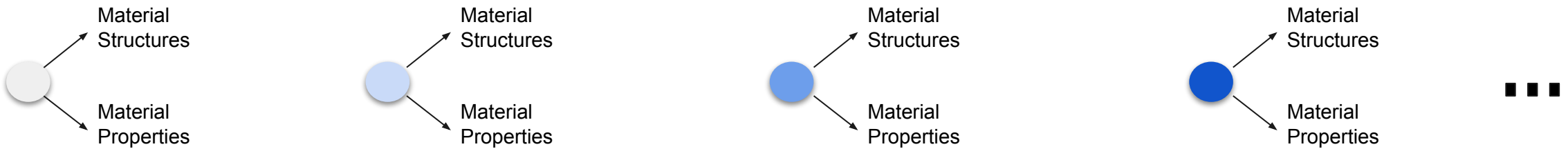
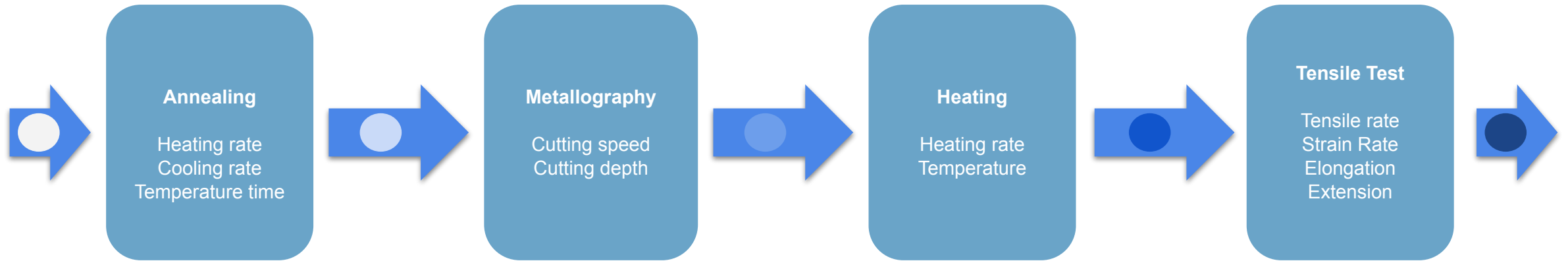


Measurements

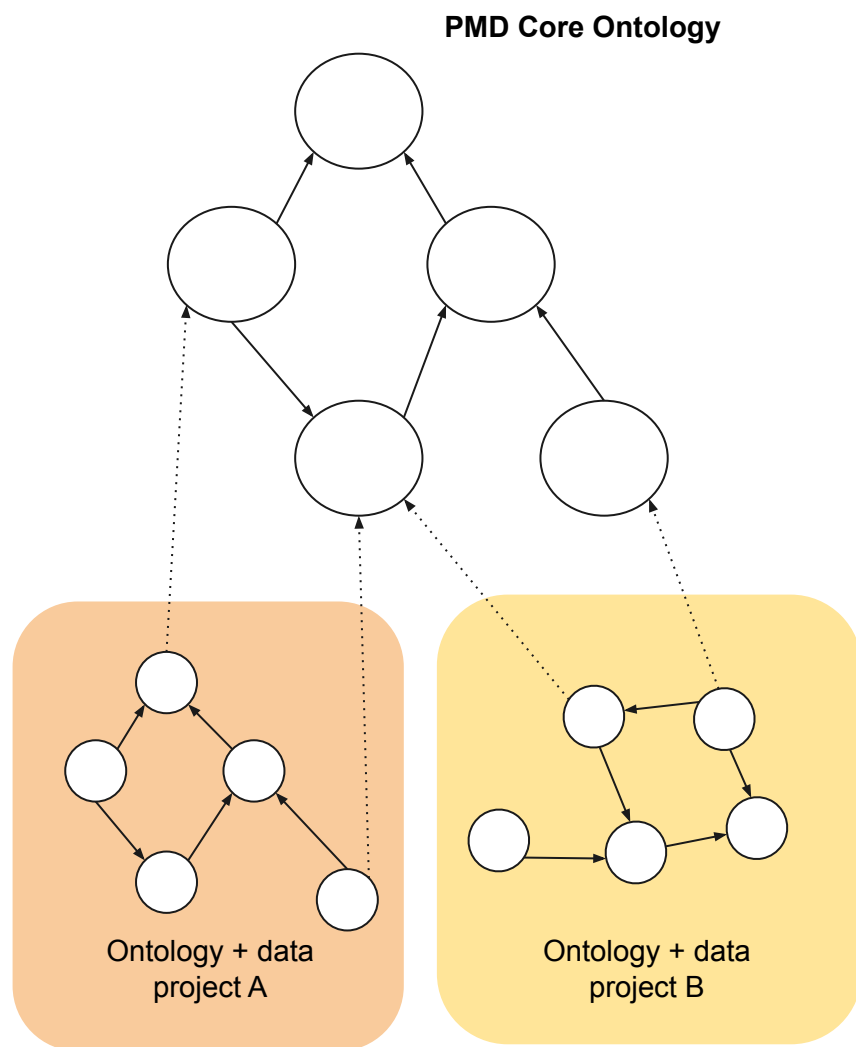


PMD Core Philosophy

 = an object that undergoes a process



Processes can **transform material structures** and **material properties** creating new objects



- The PMD Core Ontology should provide a **common semantics** for all the involved PMD projects
- PMD projects can define their own ontologies by **extending the PMD Core Ontology**
- Different PMD projects **can share their data** using a common vocabulary
- Through the PMD Core Ontology data coming from different PMD projects can be **discovered, shared, reused, and analyzed**.

What's next

- The PMD Core Ontology is not complete
 - ... during its development project use cases were not known
- We need to collect requirements from each project and further develop the core accordingly
- We will use a curation process to give everyone the possibility to suggest what is needed in the core to develop the use cases
 - more than one project might define the same concept in different ways and with different purposes, discussions are necessary to converge to a solution