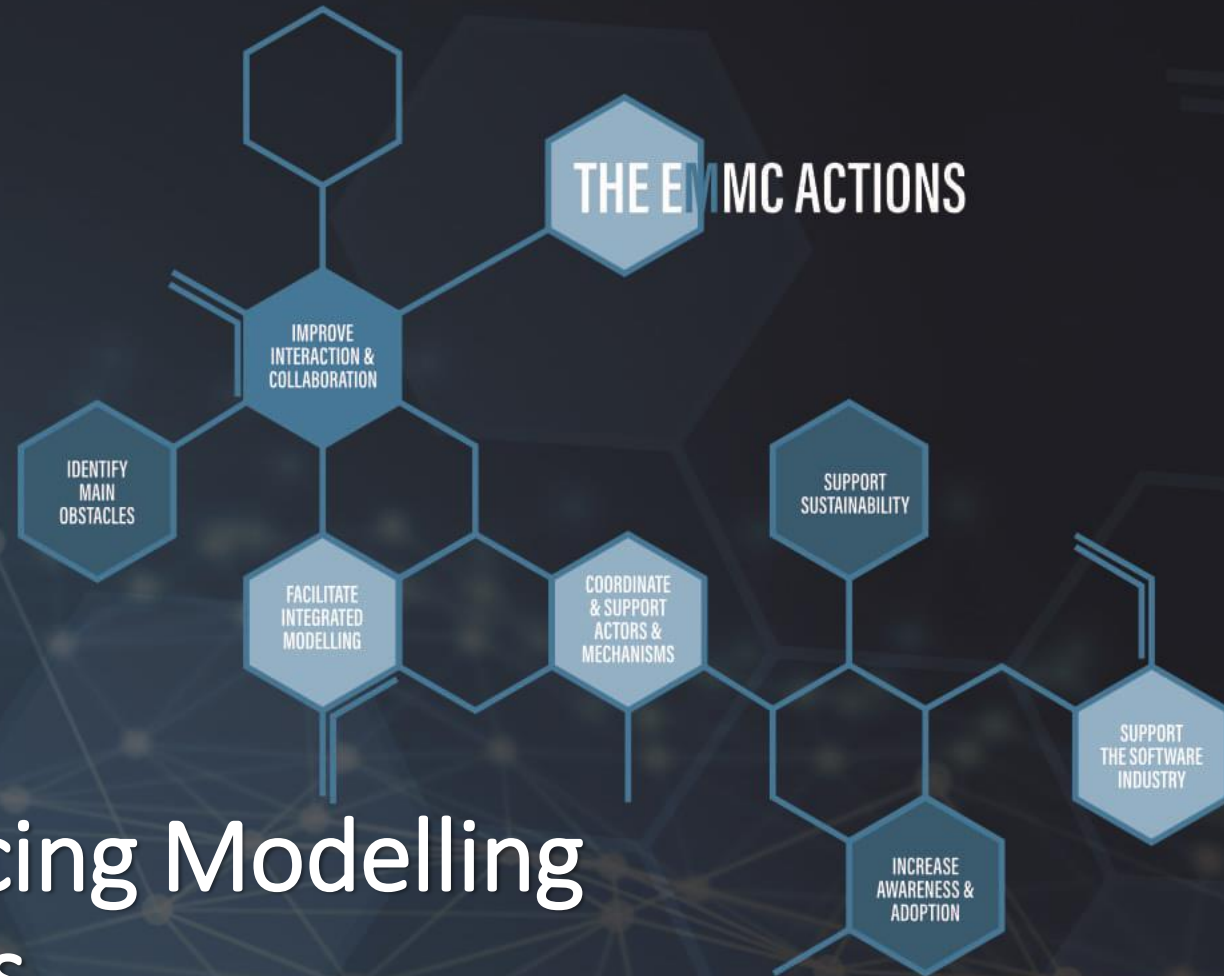




EMMC: A Community Advancing Modelling and Digitalisation of Materials



Gerhard Goldbeck (EMMC Executive Secretary)



History

2014: Informal Association of European Stakeholders

2016: EU funding (H2020 NMBP Coordination and Support Action)

2019: Established in Brussels (Belgium) as non-profit association, **EMMC ASBL**

FACILITATE INTEGRATED MATERIALS MODELLING & DIGITALISATION

OVERCOME OBSTACLES TO UPTAKE BY INDUSTRY, INCREASE IMPACT

SUPPORT INDUSTRIAL DEPLOYMENT OF SOFTWARE

COORDINATE ACTORS, IMPROVE INTERACTIONS & COLLABORATION

N° d'entreprise : 0731621312

Nom

(en entier) : **EMMC**

(en abrégé) :

Forme légale : Association sans but lucratif

Adresse complète du siège Avenue Louise 54

: 1050 Bruxelles

Objet de l'acte :

CONSTITUTION

www.emmc.eu



EMMC ASBL Founding Organisational Members



LUXEMBOURG
INSTITUTE OF SCIENCE
AND TECHNOLOGY



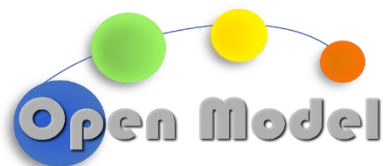
All Members, see:
<https://emmc.eu/members/>

- > 50 Organisational Members
- > 30 Full Individual Members
- > 800 Associate Members



EMMC related projects

<https://emmc.eu/emmc-related-projects/>



ZEOCAT-3D

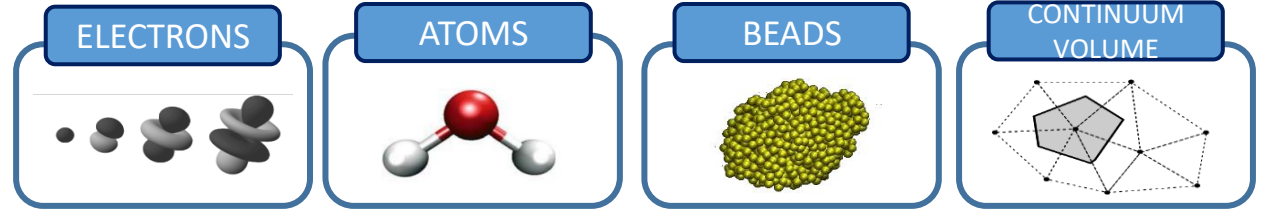


... and more



What is special about EMMC?

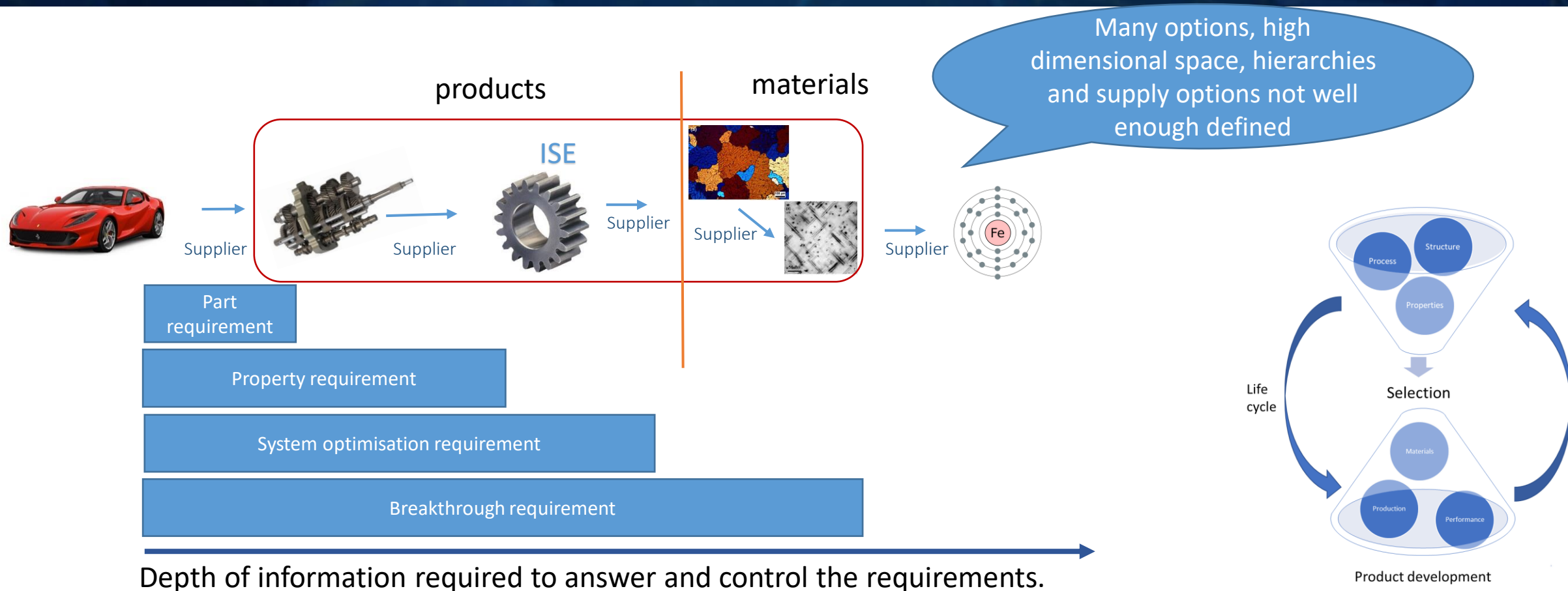
- Includes **ALL** types of modelling
Physics and data based



- Includes **ALL** chemical/material and application fields
- Includes **ALL** types of roles: Code authors/software owners (academic & commercial), modelling expert and materials manufacturers, consultants and so-called translators etc.
- **Supports harmonisation and standardisation in terminologies, taxonomies and ontologies for improved communication and interoperability (Human-human, machine-machine)**



Knowledge based materials integrate depth of design, sustainability and support breakthroughs



Requires: Interoperability of models and a common ontology



Terminology standards and EMMO ontology



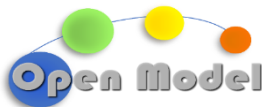
EMMO (Elementary Multiperspective Material Ontology)

<https://github.com/emmo-repo/>

A knowledge management framework for natural sciences and engineering

Started by practitioners in Materials Science in order to produce a framework consistent with scientific principles and methodologies

Developed and used in a number of projects with **governance by the EMMC**, including:



Battery Interface Genome - Materials Acceleration Platform

European Committee for Standardization

CEN COMMUNITY | TECHNICAL BODIES | STANDARDS EVOLUTION AND FORECAST | SEARCH STANDARDS

Technical Bodies > CEN/WS MODA > CWA 17284:2018

CEN/WS MODA - Materials modelling terminology, classification and metadata

General | Work programme | Published Standards

Project		Implementation Dates	
Reference	CWA 17284:2018	date of Ratification (DOR) (1)	2017-12-03
Title	Materials modelling - Terminology, classification and metadata	date of Availability (DAV) (2)	2018-04-18

https://www.cencenelec.eu/media/CEN-CENELEC/CWAs/RI/cwa17284_2018.pdf



EMMC RoadMaps 2023, 2020, 2018, 2016, 2015



EMMC Roadmap

Materials Modelling and
Digitalisation of the Materials Sciences

EMMC ASBL

The European Materials Modelling Council

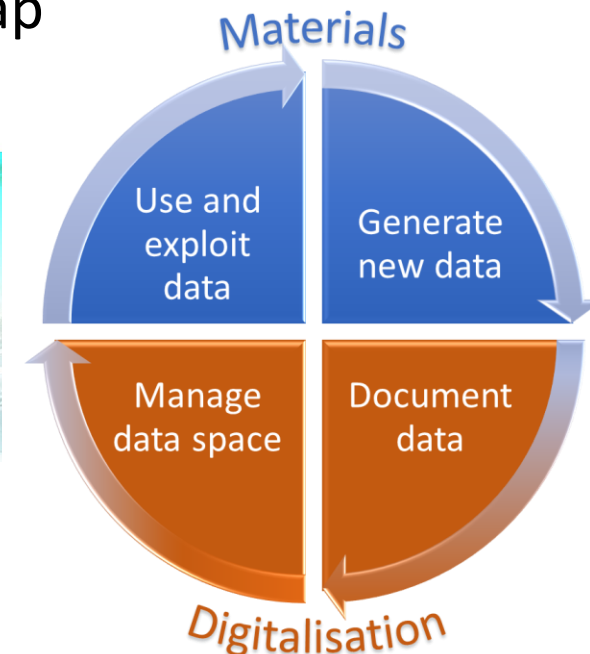
2023 Roadmap on the
“Digital Transformation of Materials Science and Engineering”

Also reflected in the AMI2030 Roadmap



www.ami2030.eu

<https://emmc.eu/emmc-roadmaps/>





The Need for a Materials Ontology

In 2018 several European practitioners in Materials Science under the governance of the EMMC expressed the need to develop a **knowledge framework** consistent with **scientific principles and methodologies** to complement the **existing physical-mathematical approach**.

The **Elementary Multiperspective Material Ontology (EMMO)** is an ontology developed to represent such knowledge framework.



<https://emmc.eu/>



<https://github.com/emmo-repo/EMMO>



EMMO levels

Ontological level

Module level

Example modules/domain ontologies

EMMO core

Top level
(TLO)

Mereocausality

mereocausality, standardmodel

Perspectives

Ex: persistence, holistic, semiotics, data, reductionistic...

Middle level
(MLO)

Reference level (RLO)

Multiperspective

Ex: persholistic, information, symbolic, properties, ...

Domain Reference level
(DRLO)

Disciplines

Ex: metrology, models, materials, ...
includes SI and QUDT Units Ontology, VIM

Domain level
(DLO)

Domains
(sub-disciplines)

Ex: Batteries (BattINFO), Crystallography, Additive
manufacturing (DOAM), ...

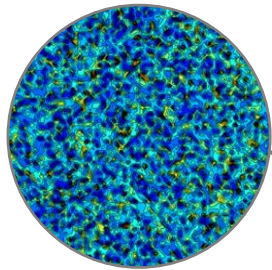
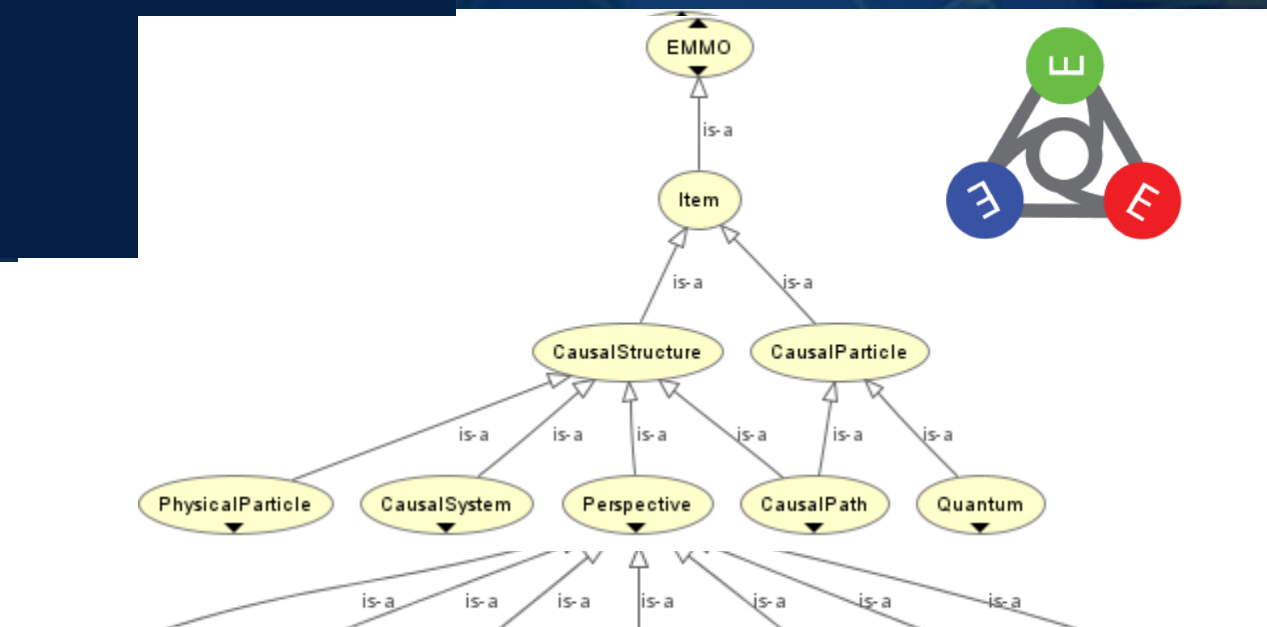
Application level
(ALO)

Applications

Application specific ontologies. Not always shared

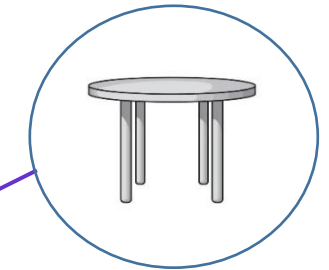
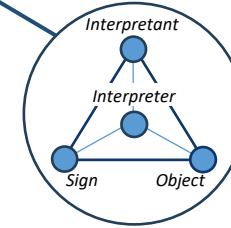
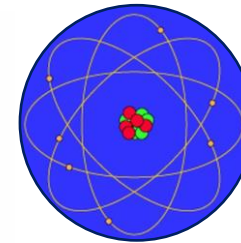
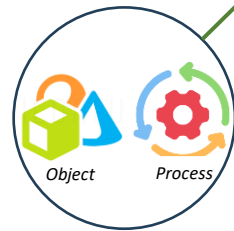
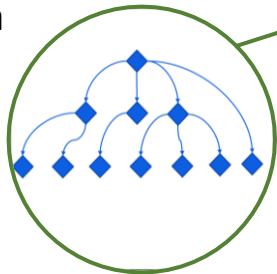


EMMO Core



Data

- Contrasts
- Encoded data
- Information



Reductionistic

- Direct parthood
- Countability
- Ordering

Persistence

- Process
- Objects

Perceptual

- Audio
- Visual
- Olfactory etc

Physicalistic

- Matter
- Field
- Material

Semiotics

- Signs/Icons
- Models
- Properties

Holistic

- Whole
- Parts (roles)



EMMO is strongly rooted in a physical-mathematical description of the world



has_part



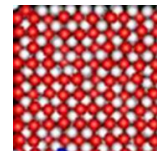
has_part



has_part



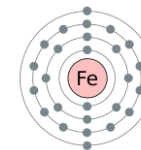
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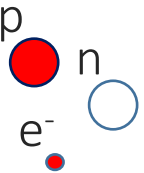
has_part



has_part



has_part



- Ability to decompose things at multiple granularity level
- Representation of things that can be readily understood by applied scientists
- Facilitates the application of modelling approaches (physics and data based) to the application user cases



Collaboration with KGA: - based on aligned objectives

Harmonization and standardization of terminologies, taxonomies and ontologies

- EMMC represents and coordinates the materials science and engineering community.
 - Collaborates with **EMCC** (characterization council)
 - Works with national projects (e.g. iENTRANCE in Italy and SFI PhysMet in Norway)
 - Initiated RDA Working Group in materials terminologies and metadata, with US, Korea, Japan
 - Coordinates domain ontologies in Materials applications, large effort e.g. in Battery materials and technologies



KGA – EMMC collaboration

Industry-standard guidances, maturity, confidence for industrial investment

- EMMC community can greatly benefit from KGA attention to these issues.

Pluralism

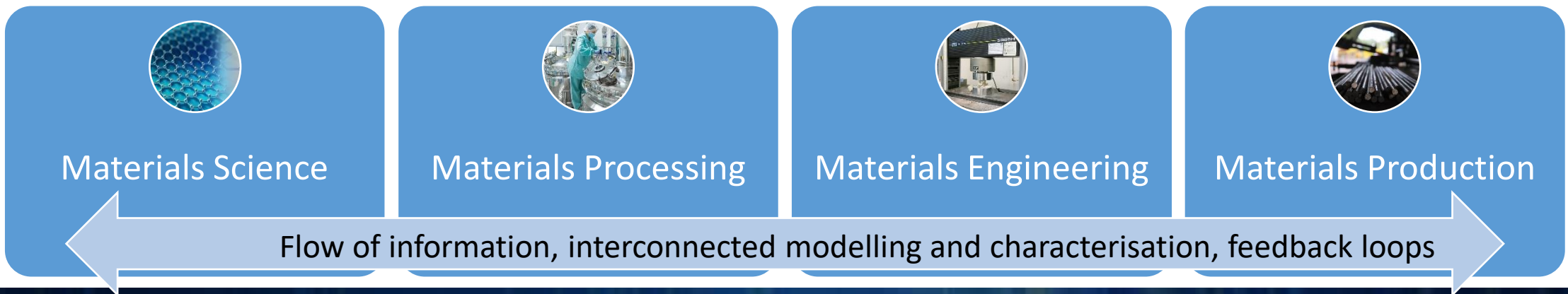
- closely aligned with the pluralistic approach of EMMO and the TRO concept in OntoCommons, supported by EMMC

Interoperability

- EMMC and EMMO community interested in continued work on TRO and mid-level harmonised (bridge) concepts



- EMMC supports all stakeholders along the materials value chain.
- EMMC is the community for materials modelling and semantics, based on materials science domain expertise.
- EMMC supports materials digitalization, also via AMI2030
- EMMC is keen to enhance its interactions with data and semantic knowledge graph stakeholders via the new KGA

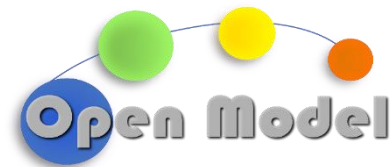




Contributing projects acknowledgement

Funding from the European Commission via the Horizon 2020 projects

- OntoCommons (GA n. 958371) www.ontocommons.eu
- OntoTrans (GA n. 952869) www.ontotrans.eu
- OpenModel (GA n. 953167) www.openmodel.eu
- NanoMECommons (GA n. 952869) www.nanoMECommons.eu





Join us:

<https://emmc.eu/register/>



Acknowledgement:

Many EMMC Members contributed via inputs to roadmaps, workshops, position documents that have been used as a basis for this presentation