HELMHOLTZ
Metadata Collaboration

The EM Glossary:

a community effort towards a harmonized terminology in electron microscopy

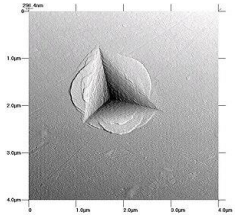
Oonagh Brendike-Mannix, Christoph Pauly, Markus Kühbach, Markus Wollgarten, Peter Konijnenberg,
Rasmus Schroeder, Rossella Aversa, Sandor Brockhauser, Özlem Özkan,
Mojeeb Rahman Sedeqi, Abril Azocar-Guzmann, Volker Hofmann, Stefan Sandfeld
and > 20 contributors from the EM community

2024 HMC Conference

Applied Metadata in Electron Microscopy

instruments

human
community



laboratory
ELN

large scale
infrastructure

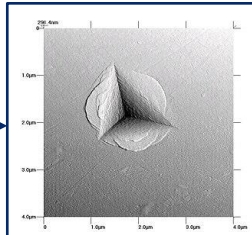
analysis/
simulation/
publication

The EM Glossary connects applications on the domain level

instruments

human community

EM GLOSSARY

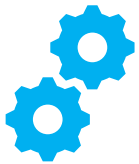


laboratory ELN

large scale infrastructure

analysis/ simulation/ publication

EM Glossary objectives



EM GLOSSARY

Improve interoperability

- Machine and human readable glossary
- Semantic glue technology between microscopy applications

Networking

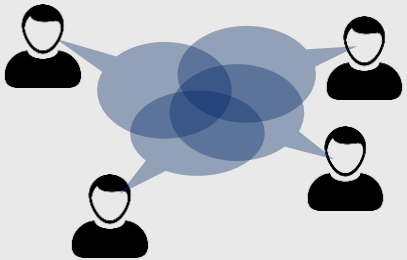
- Prevent siloing of initiatives
- Forum for exchange on best practices

Guided by the following philosophy

- **Transparent**
  open & fully documented development in GitLab
  microcredits for contributors
- **Relevant & community accepted**
  strategic term prioritization based on relevant data and projects
  consensus on terms and their meaning across a broad community
- **Machine actionable & FAIR**
  ensure compatibility with semantic web standards
  easy crosswalks to other relevant projects
- **Persistent**
  HMC implemented and maintained
  continuous development with community

EM Glossary has 4 elements developed in parallel

scientific content development

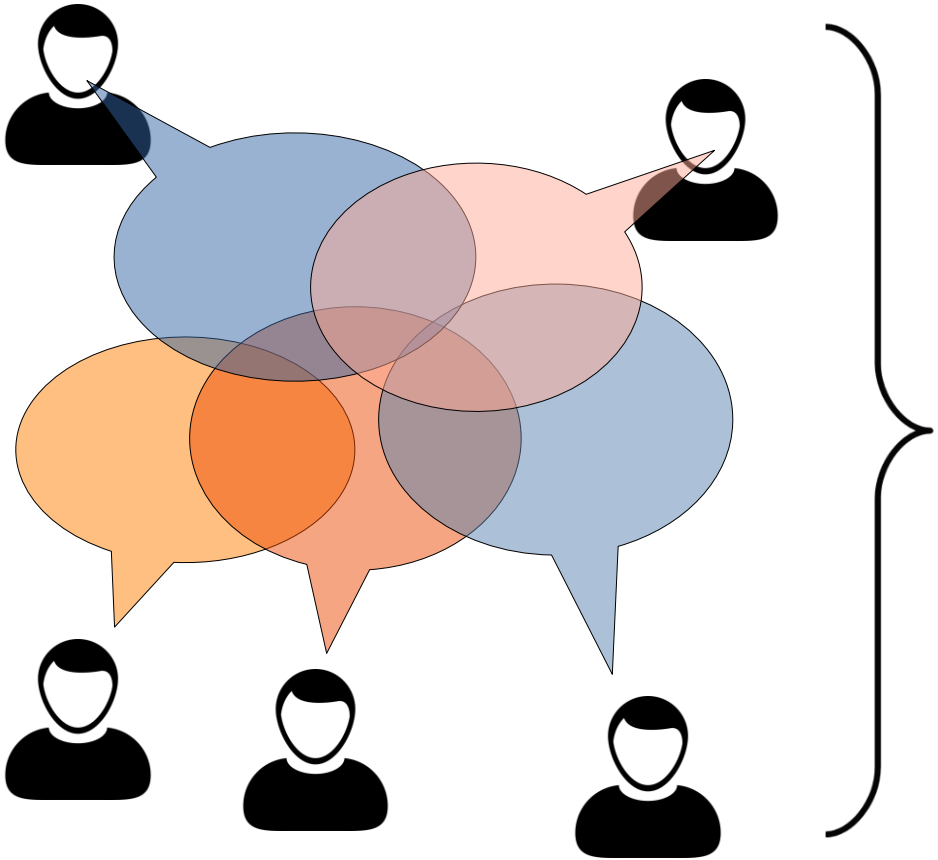


semantic artifact in OWL

web explorer

application-level adoption support

Scientific Content Development



! Term.yml ●

home > v.hofmann > WORKING > EM_Glossary > ! Term.yml > ...

```yaml
---#·Free-text·name·of·definition·source·
labels:·
··label_en:·term
singular:·
··singular_en:·terms
plural:·
··plural_en:·terms
synonyms:·
··exact_synonym_en:·
····-·idiom
··broad_synonym_en:·
····-·expression
····-·phrase
····-·word
iri:·https://iris.hmc-services.de/term_00000001
definitions:·
··definition_en:·>·
····a·expression·that·(1)·has·a·precise·meaning,·and
····(2)·is·used·to·describe·a·thing.
sources:·
··-·https://www.merriam-webster.com/dictionary/term
comments:·
··comment_en:·>·
····The·meaning·of·a·term·might·be·different·in·different
····contexts·i.e.·such·as·e.g.·in·different·scientific·
····fields.·The·expression·is·usually·labeled·by·a·specific·
····string·and·might·have·synonyms·and·antonyms.
contributors:·
··-·https://orcid.org/0000-0003-0000-4784
··-·https://orcid.org/0000-0002-1008-4530
··-·https://orcid.org/0000-0002-5149-603X
ratified:·False
```

definitions
in genus-differentia form

A** is a **B** which **C
A** is a **B** during which **C

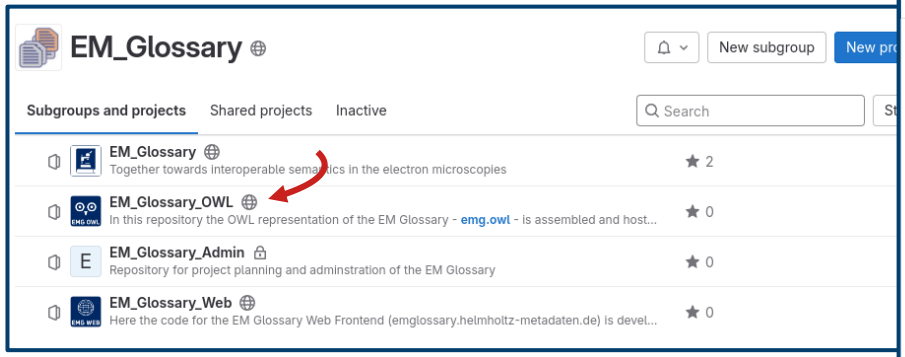
Scientific Content Development

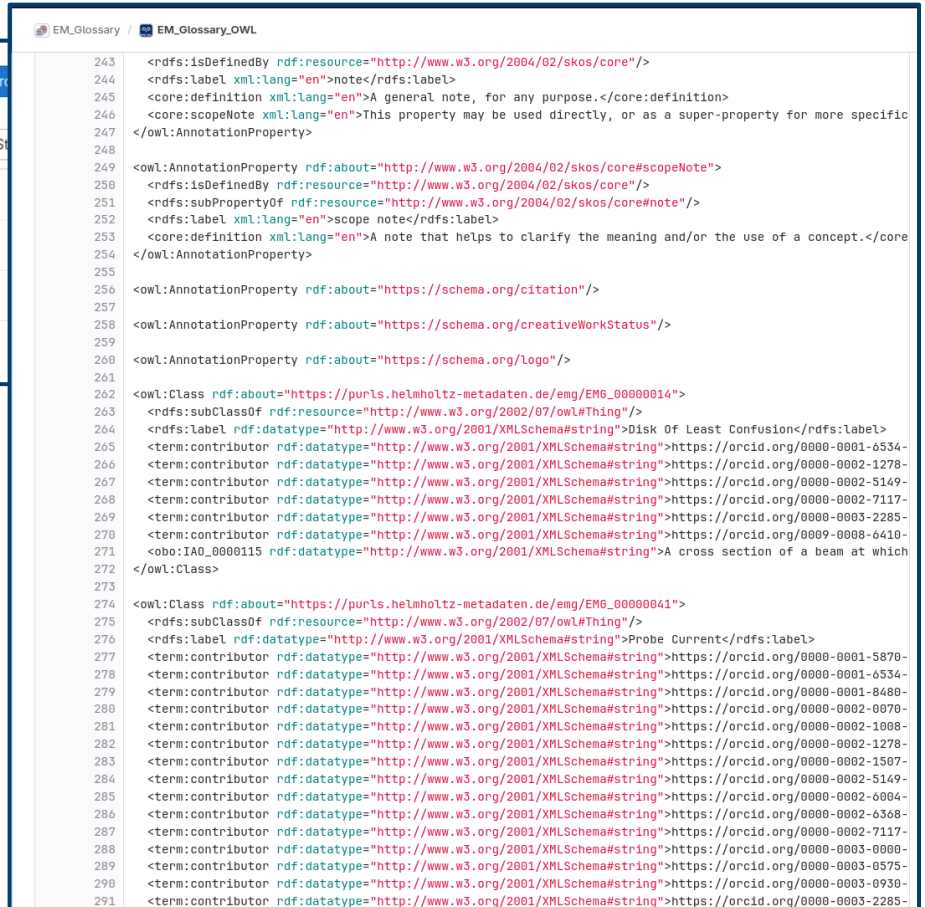
Term.yml

home > v.hofmann > WORKING > EM_Glossary > Term.yml > ...

```yaml
---#·Free-text·name·of·definition·source·
labels:·
··label_en:·term
singular:·
··singular_en:·terms
plural:·
··plural_en:·terms
synonyms:·
··exact_synonym_en:·
····-·idiom
··broad_synonym_en:·
····-·expression
····-·phrase
····-·word
iri:·https://iris.hmc-services.de/term_00000001
definitions:·
··definition_en:·>·
····a·expression·that·(1)·has·a·precise·meaning,·and
····(2)·is·used·to·describe·a·thing.
sources:·
··-·https://www.merriam-webster.com/dictionary/term
comments:·
··comment_en:·>·
····The·meaning·of·a·term·might·be·different·in·different
····contexts·i.e.·such·as·e.g.·in·different·scientific·
····fields.·The·expression·is·usually·labeled·by·a·specific·
····string·and·might·have·synonyms·and·antonyms.
contributors:·
··-·https://orcid.org/0000-0003-0000-4784
··-·https://orcid.org/0000-0002-1008-4530
··-·https://orcid.org/0000-0002-5149-603X
ratified:·False
```

Semantic Artifact

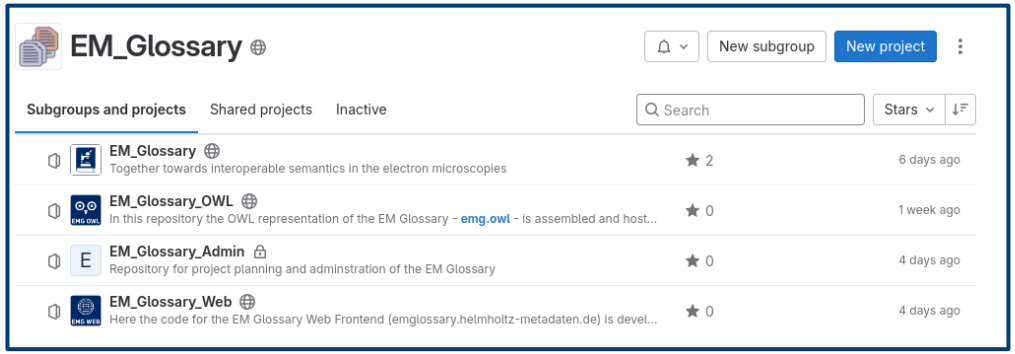


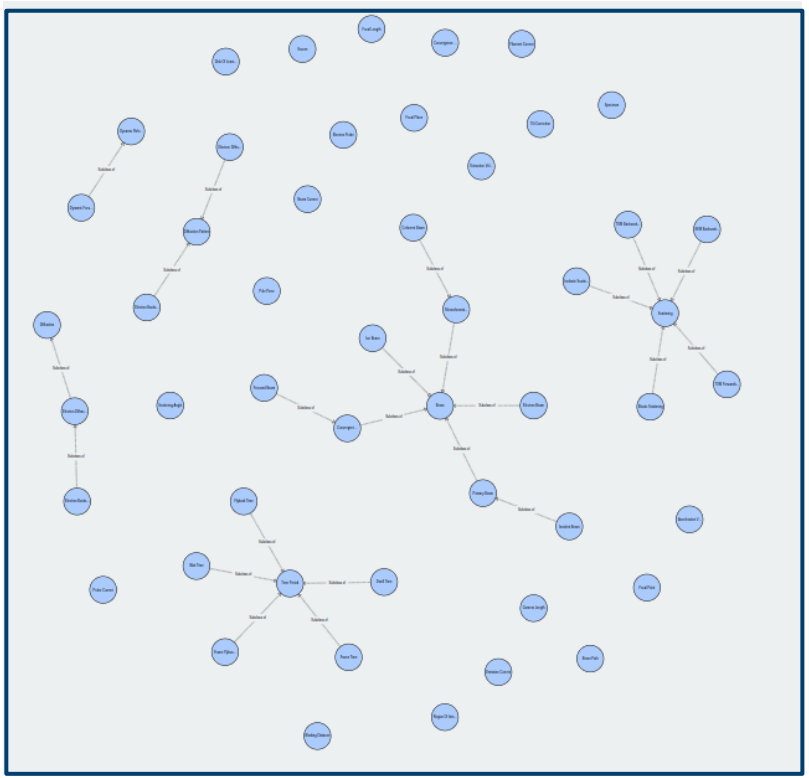


EMGlossary.owl

https://purls.helmholtz-metadaten.de/emg

Implementation in OWL for machine readability & technical adoption

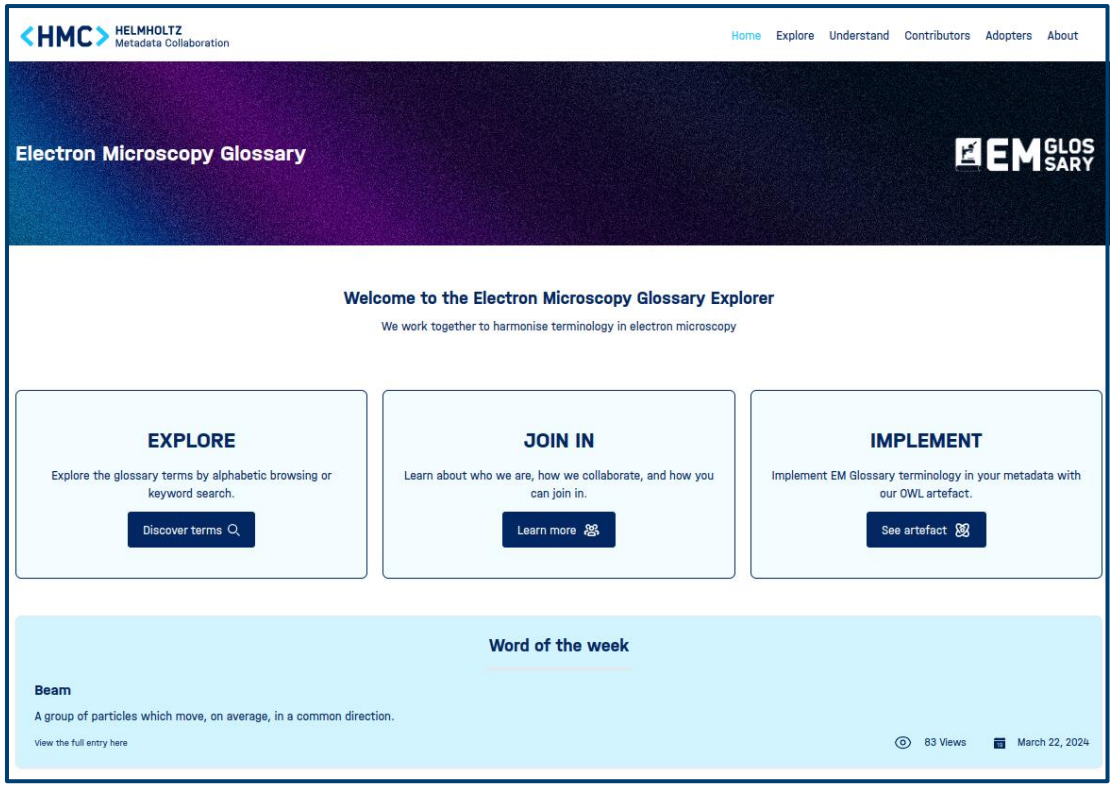




EMGlossary.owl

https://purls.helmholtz-metadaten.de/emg

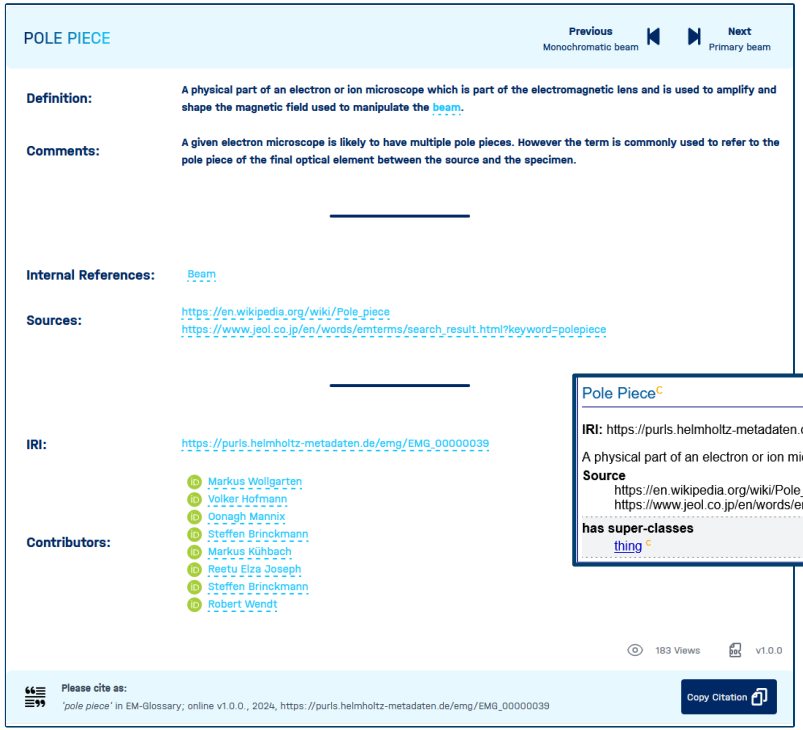
EM Glossary Web Explorer

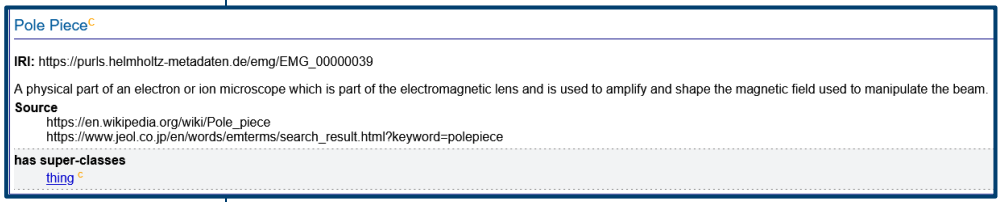


Web Explorer

https://emglossary.helmholtz-metadaten.de/

User pathways between Explorer and OWL artifact



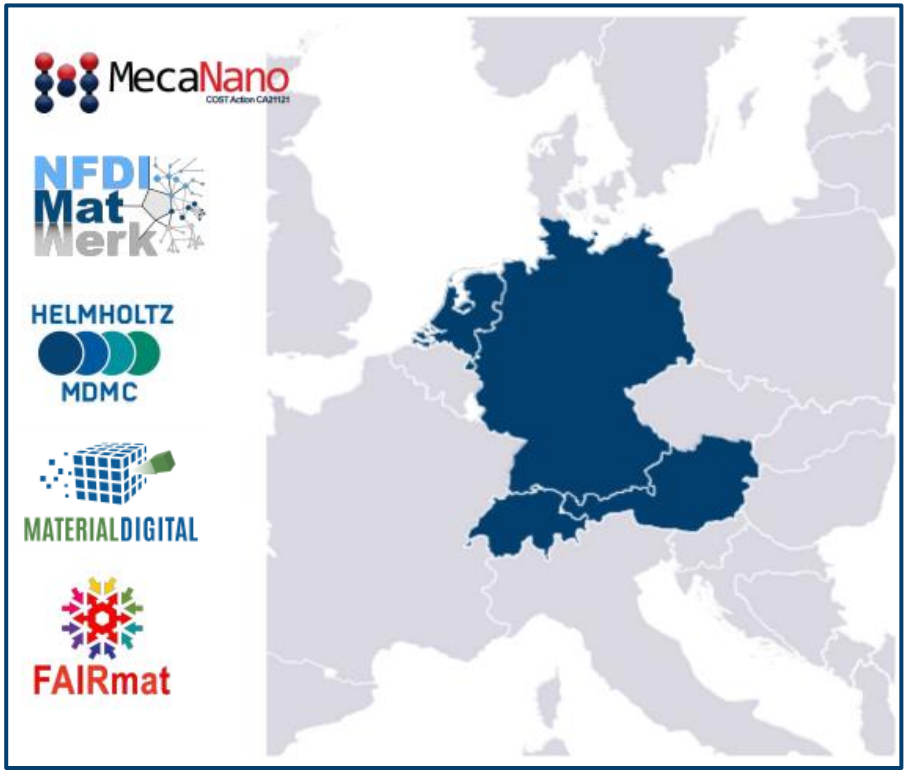


Web Explorer

https://emglossary.helmholtz-metadaten.de/

Adoption happens across projects and communities

- technical support & guidance during adoption
- semantic versioning & release cycle management
- extension of terminology through further scientific development

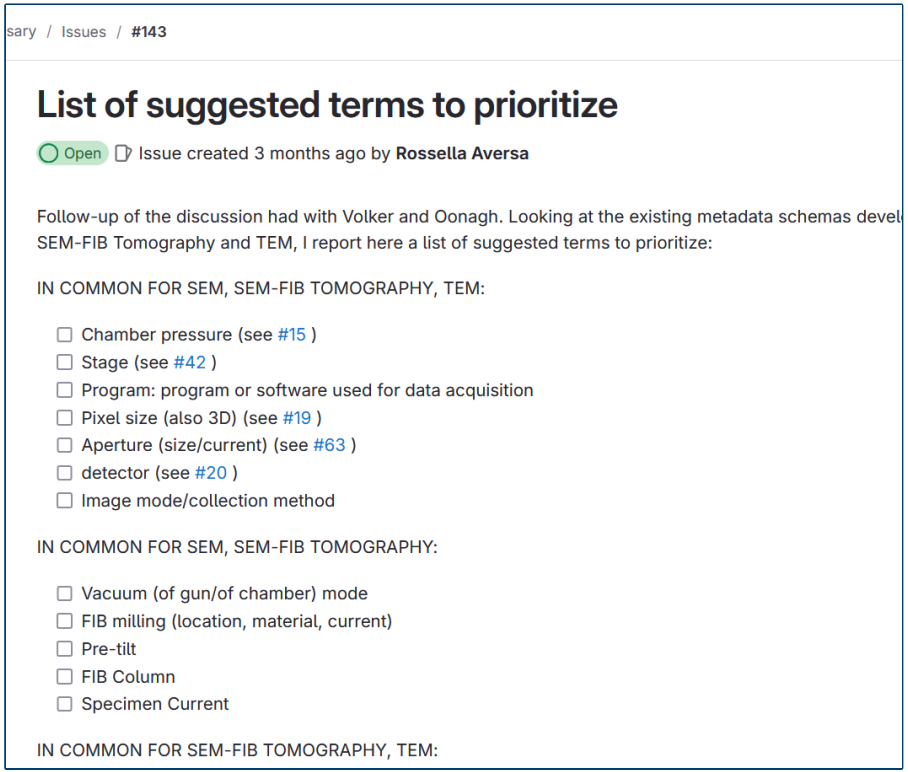


Web Explorer

https://emglossary.helmholtz-metadaten.de/

Adoption identifies missing terms

- feedback from adopters fed back to community
- final direction comes from community
- leads to use-case focused developments which bring benefits which lead to further adoption (and happy scientists)



sary / Issues / #143

List of suggested terms to prioritize

Open Issue created 3 months ago by **Rossella Aversa**

Follow-up of the discussion had with Volker and Oonagh. Looking at the existing metadata schemas devel
SEM-FIB Tomography and TEM, I report here a list of suggested terms to prioritize:

IN COMMON FOR SEM, SEM-FIB TOMOGRAPHY, TEM:

- ☐ Chamber pressure (see #15)
- ☐ Stage (see #42)
- ☐ Program: program or software used for data acquisition
- ☐ Pixel size (also 3D) (see #19)
- ☐ Aperture (size/current) (see #63)
- ☐ detector (see #20)
- ☐ Image mode/collection method

IN COMMON FOR SEM, SEM-FIB TOMOGRAPHY:

- ☐ Vacuum (of gun/of chamber) mode
- ☐ FIB milling (location, material, current)
- ☐ Pre-tilt
- ☐ FIB Column
- ☐ Specimen Current

IN COMMON FOR SEM-FIB TOMOGRAPHY, TEM:

Web Explorer

https://emglossary.helmholtz-metadaten.de/

Activating a community took time & effort

Sept 20
1st interaction

Feb 21
workshop to gather needs

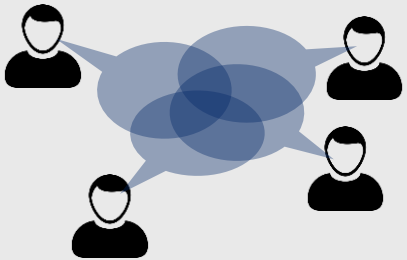
Aug 21
poster at microscopy conference

Sept 21
attend at IGEME 21

Oct 21
kickoff for EM Glossary

And maintaining it takes more…..

Community Managers



Knowledge Engineer

Web Developer

Adoption consultants

Resources provided by HMC

Outlook

- Next EMG.OWL release
- Upgrade Web Explorer with adopter stories
- Upgrade Web Explorer back-end
- Scientific paper on methodology
- More definitions!
- More outreach!
- More adoption!

JOIN IN!

https://emglossary.helmholtz-metadaten.de/about

Acknowledgements

Scientific content

Dr. Markus Wollgarten
Prof. Dr. Rasmus Schröder
Dr. Peter Konijnenberg
Dr. Ing Markus Kühbach
Prof. Cecile Hebert
Dr.-Ing. Christoph Pauly
Prof. Dr. Helmut Kohl
Dr. Reetu Elza Joseph
Dr. Robert Wendt
Dr. Steffen Brinckmann
Dr. Rosella Aversa
Dr. Adrien Teutrie
Dr. Clemens Mangler
Ashish Suri

Community Management & Technical Implementation

Volker Hofmann
Oonagh Brendike-Mannix
Özlem Özkan
Abril Azocar-Guzman
Mojeeb Rahmann Sedeqi