BATTERY 2030+ Roadmap Workshop Oslo

Goals for Standardisation

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BATTERY 2030+

Why do we need standard protocols?

Comment | Published: 12 February 2024

My cell is better than yours

Nella M. Vargas-Barbosa ✉

Nature Nanotechnology 19, 419–420 (2024) | Cite this article
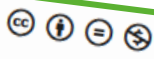
4735 Accesses | 10 Altmetric | Metrics

Editorial | 🔓 Free Access

Ten Ways to Fool the Masses When Presenting Battery Research**

Prof. Patrik Johansson ✉, Dr. Sajid Alvi, Pedram Ghorbanzade, Martin Karlsmo, Dr. Vigneshwaran Thangavel, Kasper Westman, Fabian Årén

First published: 01 October 2021 | https://doi.org/10.1002/batt.202100154 | Citations: 9

** Heavily inspired by and a homage to Ref. [1]. Editorial note: This Editorial article is written in a humorous tone and has been peer reviewed. It should not be taken as literal advice by the scientific community.

Research Article | 🔓 Open Access | cc ① ⊜ ⑤

Round-robin test of all-solid-state battery with sulfide electrolyte assembly in coin-type cell configuration

Alexander Beutl ✉, Ander Orue ✉, Pedro López-Aranguren, Andrea Itziar Pitillas Martinez, Maria Helena Braga, Ville Kekkonen, Artur Tron ✉

First published: 29 March 2024 | https://doi.org/10.1002/elsa.202400004

Research Article | 🔓 Open Access | cc ① ⊜ ⑤

Potential and Limitations of Research Battery Cell Types for Electrochemical Data Acquisition

Dr. Anna Smith ✉, Dr. Pirmin Stüble, Dr. Lea Leuthner, Dr. Andreas Hofmann, Dr. Fabian Jeschull, Liuda Mereacre

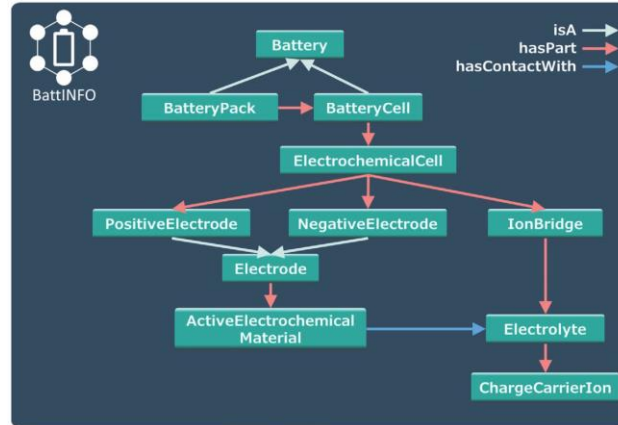First published: 20 March 2023 | https://doi.org/10.1002/batt.202300080 | Citations: 4

→ Compare results from different "competing" labs

→ Compare results from different collaborating labs

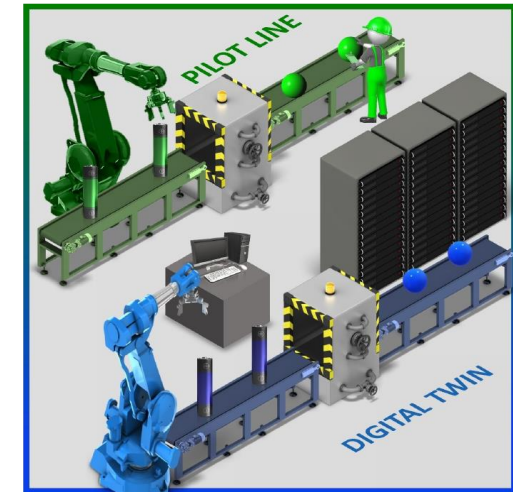→ **Boost collaboration & innovation**

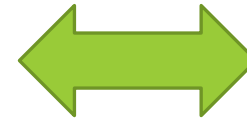# Best Practices for standard protocols for theory and experiment

Ontologies & Dynamic DMPs

Clark et al., *Adv. Energy Mater.* (2021) 2102702

Modelling & Digital Twins

DEFACTO / LiPlanet

Underlying data must be not only FAIR but FAIR^4

Best Practices – Battery2030+

FAI**R⁴ Data:**

F - Findable

A - Accessible

I - Interoperable

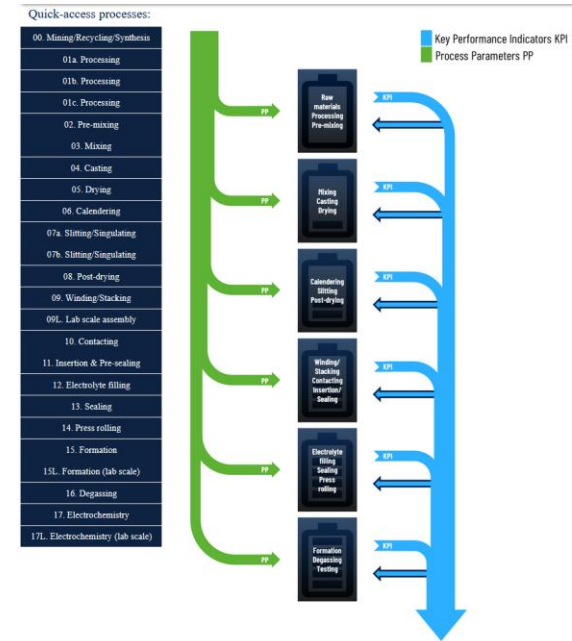**R⁴**
- Reusable
- Reproducible
- Reliable
- Relevant

Data „Quality"

Work together with Fraunhofer ISC & SINTEF:

BATTERY 2030+ Knowledge base (2.0)

Previous Work:

- Battery 2030+ Knowledge base 1.0:
  https://www.celest.de/en/or/layer1
- Open Semantic Lab: https://github.com/OpenSemanticLab
- KIproBatt Project Wiki: https://kiprobatt.de/wiki/Main_Page
- EMMO Ontologies https://onto-wiki.eu/wiki/Main_Page
- BattINFO https://github.com/BIG-MAP/BattINFO

Work together:

- Knowledge Base on Open Semantic Lab:
- https://battery.knowledge-graph.eu/wiki/Main_Page

Battery Knowledge Base
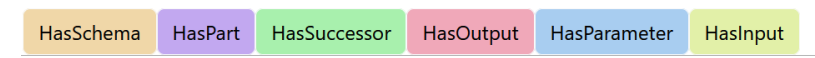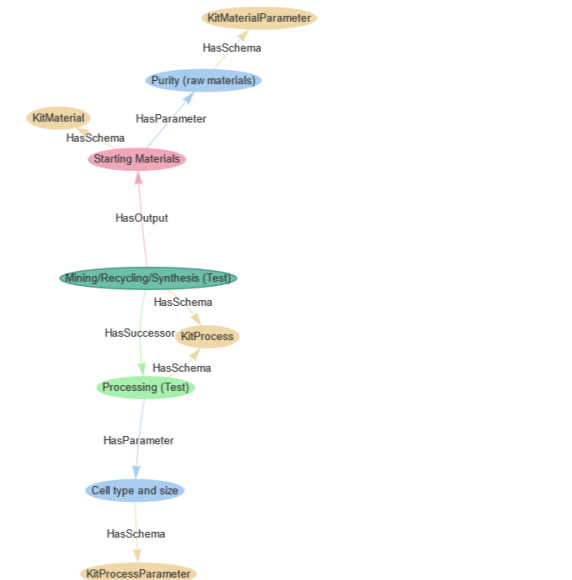
What comes now?

- **Filling of the knowledge base with more content on measuring techniques**

- **Connect knowledge base with ontologies**

- **Including the BATTERY 2030+ community into the review process of the knowledge base**

  - Harmonisation with existing ontology work in BIG MAP and BATTERY 2030+

  - Link knowledge base to BIG MAP Online Lab Book, Coin Cell assembly SOP, etc.

  - Direct input from research community

- **Encouraging the BATTERY 2030+ community to use and further improve the knowledge base in a collaborative way**

  - Link relevant research papers

  - Link relevant standards

  - **Agree on common standards within the consortium**

  - Best practice guides, technical reports, technical specifications

→ **Boost collaboration & innovation**

Ontologies and standards in the roadmap

Contents

Ontologies and standards in the roadmap

Roadmap page 107: **Table 5. S**hort-, medium-, and long-term goals for Standardization in the research areas.

	Short term (3 years)	Medium term (6 years)	Long term (10 years)
BIG-MAP & Standards	Continue the development of the ontology eco system.	Go **from** the **Electronic Lab Notebook (ELN) to** the **Lab as a Service (LaaS)**.	Accelerate research by use of ontologies & standards.
	Establish international collaborations.	**Utilize the ontologies and standards to make data fully FAIR.**	
	Realize a broad implementation of the Battery 2030+ Electronic Lab Notebook (ELN).	Have well-defined & standardized interfaces to enable reproducibility & interoperability.	
	Find attractive ways for researchers to use ontologies and standardization.		
	Find ways to include new metadata and observations in otherwise standardized processes.		
Sensing & Standards	Ensure a transparent flow of information and enable the comparability of sensor results (sensor sensitivity and type, data postprocessing, environmental conditions etc.).	Integrate sensor connectivity and data management with the BMS interface at the cell, module, and pack levels while maintaining compatibility with battery manufacturing processes.	Standardized communication with the BMS and generation of standardized sensor data for the Battery 2030+ Electronic Lab Notebook (ELN).
	Define how to determine data from measurements for each sensor type.	**Standardisation of the sensor integration process and connections.**	
	Ensure the metrological traceability of sensors with regards to primary references in order to ensure comparable measurements and hence more meaningful experiments.		Automatized and standardized insertion of advanced sensors in the new generation cells.
	Define and report measurement conditions for each sensor type in use (e.g. definition of the compression frame for pouch cells.).		
	Implement unified calibration procedures for certain sensor types (especially for sensors inside the cell).		
Self-healing & Standards	Short-term standarization activites not relevant due to low TRL.	**Evaluation of the need for standardization activities, based on the results of the ongoing BATTERY 2030+ projects.**	First standardization activities for self-healing components in the cell.
	Clear definition of self-healing needed (both for autonomous and triggered).		
Manufacturability, Recyclability & Standards	**Standardization of metadata reports and data produced by digital tools** (battery models, etc.) in use.	Process neutral and machine open standardization.	Be able to hand over full battery history (battery passport: chemistry, manufacturing protocols, SoH,...) to recyclability.
	Standardized protocols and reports in use.	Standardized & interoperable **Battery 2030+ Electronic Lab Notebook (ELN)** in use.	Standardized interoperable automated data acquisition for the **Battery 2030+ Electronic Lab Notebook (ELN)**.
	Inline quality control for common chemistries and processes in place.	**Standardization in validation of digital tools**.	
	Find ways to handle sensitive data.		

	Short term (3 years)	Medium term (6 years)	Long term (10 years)
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	Short term (3 years)	Medium term (6 years)	Long term (10 years)
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Draft Standardisation Goals for the 2025 Roadmap

	Short term (2026/2027)	Medium term (2030)	Long term (2035)
BIG-MAP & Standards	Find attractive ways for researchers to use ontologies and standardization.	Accelerate research by use of ontologies & standards.	New goal(s) here?
	Find ways to include new metadata and observations in otherwise standardized processes.		
	Go from the Electronic Lab Notebook (ELN) to the Lab as a Service (LaaS).		
	Utilize the ontologies and standards to make data fully FAIR.		
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	Standardized protocols and reports in use.	Standardized & interoperable Battery 2030+ Electronic Lab Notebook (ELN) in use.	Standardized interoperable automated data acquisition for the Battery 2030+ Electronic Lab Notebook (ELN).
	Inline quality control for common chemistries and processes in place.	Standardization in validation of digital tools.	
	Find ways to handle sensitive data.		

World Café Table on Standards

- **Discuss the short/medium/long-term goals for standards connected to the different other topics for the 2025 Roadmap**

- **Discuss structure: Move Standards from chapter 4.4.2 and chapter 8 into one chapter?**

- **SWOT of the topic standards**