GUIDANCE FOR DATA IN PUBLICATIONS

A checklist for Li-batteries process- and equipment parameters in publications

EXECUTIVE SUMMARY

The overall objective of LiPLANET is to support the European innovation and production ecosystem by forming a network of lithium battery cell pilot lines that integrates industrial stakeholders and establishes unique selling propositions towards EU industry in support of its market access within the cell manufacturing ecosystem. Moreover, reinforcing the position of the European Union (EU) in the lithium battery cell manufacturing market will be further achieved by exploiting synergies between pilot line operators, identifying knowledge and equipment gaps, creating common training and standardization initiatives, and ultimately jointly developing strategies for scaling up the impact of the network.

To reinforce the European battery production and to boost innovation, transparent and comparable research is necessary. In addition to cooperation between the European pilot lines and other research facilities in developing common standards, basic information about the circumstances under which published results were generated is the most important aspect to reach this goal. This publication aims to contribute to improve this transparency.

IMPRINT

Publisher

LiPLANET e.V.

Volkmaroder Straße 5, 38104 Braunschweig | Amtsgericht Braunschweig VR 202117

represented by:

1st chair: Prof. Arno Kwade, Institute for Particle Technology, Technische Universität Braunschweig

2nd chair: Simon Perraud, CEA-Liten

Responsible authors

Robin Moschner Institute for Particle Technology, Technische Universität Braunschweig

Contributors & Reviewers

LiPLANET Expert group “Scientific Exchange”

Prof. Dr.-Ing. Arno Kwade

TABLE OF CONTENT

1 Introduction 4
1.1 LiPLANET in brief 4
1.2 Scope and objective of this deliverable 4
2 Guidance for data in Publications 5
2.1 Relevant data 5
2.2 Positive Examples 7

1 INTRODUCTION

1.1 LiPLANET in brief

The LiPLANET Network is a network of European battery pilot lines. The overall vision of the LiPLANET Network is to create a European innovation and production ecosystem and reinforce the position of the European Union (EU) in the lithium battery cell manufacturing market. The Network is the one-stop shop for the development, knowledge transfer and standardization of sustainable batteries and manufacturing technology. LiPLANET brings together the most relevant European lithium battery cell pilot lines and the main stakeholders of the battery sector to facilitate the creation of a more competitive lithium battery cell manufacturing ecosystem and increase the production of lithium battery cells towards industrial scale.

Within this Network, there are six Expert Groups that aim to push forward cutting-edge topics in the operation of pilot lines. These groups focus on multiple research topics, including production technology & sustainability, safety in pilot line operations, education & training, digitalization, measurement methods & quality, cell design & recyclability, and scientific exchange (round-robin). Within these groups, best practices will be identified, discussed and evaluated based on their potential to be replicated at a European-level. These groups publish reports and inform policy briefs that are disseminated to key stakeholders in the battery industry.

1.2 Scope and objective of this deliverable

Process- and equipment parameters/characteristics used for generating research results are often as important as the results themselves, because they enable other members of the scientific community to assess and evaluate these results in greater depth or even recreate them. The following deliverable is intended as a checklist for researchers regarding relevant information about the circumstances of the production of LIB electrodes and cells, which should be outlined in publications.

2 GUIDANCE FOR DATA IN PUBLICATIONS

2.1 Relevant data

Material pre-processing (dry)	
Device	Process parameters
▪ Device name ▪ Device type ▪ Device size (scale)	▪ Duration (batch) or mean residence time (cont.) ▪ Intensity like (tangential) velocity or rpm and tool sizes ▪ Cooling ▪ Mass / mass flow rate of process material ▪ Composition of process material

Processing (wet or dry)	
Device	Process parameters
▪ Dry or wet ▪ Device name ▪ Device type ▪ Device size (scale)	▪ Duration (batch) or mean residence time (cont.) ▪ Intensity like (tangential) velocity or rpm and tool sizes ▪ Cooling and/or degassing ▪ Mass /mass flow rate of process material ▪ Composition of process material

Coating (wet or dry)	
Device	Process parameters
▪ Self-metered, pre-metered, device type ▪ Device name ▪ Device size (scale)	▪ Relevant device parameters (Coating position (8 o'clock, 12 o'clock…), pressure drop, slurry feeding, …) ▪ Areal loading (whole coating and/or active material) and fresh coating height

Drying	
Device	Process parameters
▪ Drying type (Convection, conduction, radiation …) ▪ Device name ▪ Device size (scale) ▪ Device geometry (gap between nozzles or emitters, gap to substrate …)	▪ Drying intensity (temperature profile, volume flow rate and direction, radiation intensity, …) ▪ Drying duration ▪ Atmosphere

Calendering/Compression	
Device	Process parameters
▪ Device name ▪ Device type (calender, press …) ▪ Device size (scale)	▪ Temperature ▪ Line load ▪ Target density ▪ Calendering speed

Electrode post-drying	
Device	Process parameters
▪ Device name ▪ Device type (vacuum oven, continuous oven, …)	▪ Duration ▪ Temperature ▪ Atmosphere

Electrode slitting	
Device	Process parameters
▪ Process type (knife, laser) ▪ Device name	▪ Knife geometry / laser parameters

Cell assembly
▪ Cell format and size ▪ Separator type ▪ Electrode types and dimensions ▪ Assembly type (Z-folding, …) ▪ Bonding (Type, device name, …)

Electrolyte filling
▪ Electrolyte type ▪ Pressure ▪ Temperature ▪ Amount of electrolyte

Cell formation and cycling
▪ Cycling device type (Maccor, Basytec, EL-Cell, …) ▪ Voltage range ▪ Formation procedure ▪ Cycling procedure (CC,CV, C-Rate, number of cycles …) ▪ C-rates and current density ▪ Active material mass ▪ Cycling Temperature

2.2 Positive Examples

Baunach, M.; Jaiser, S.; Schmelzle, S.; Nirschl, H.; Scharfer, P.; Schabel, W. (2016): **Delamination behavior of lithium-ion battery anodes: Influence of drying temperature during electrode processing.** In: *Drying Technology* 34 (4), S. 462–473. DOI: 10.1080/07373937.2015.1060497.

Zheng, Honghe; Yang, Ruizhi; Liu, Gao; Song, Xiangyun; Battaglia, Vincent S. (2012): **Cooperation between Active Material, Polymeric Binder and Conductive Carbon Additive in Lithium Ion Battery Cathode**. In: *J. Phys. Chem. C* 116 (7), S. 4875–4882. DOI: 10.1021/jp208428w.

Bauer, Werner; Nötzel, Dorit; Wenzel, Valentin; Nirschl, Hermann (2015): **Influence of dry mixing and distribution of conductive additives in cathodes for lithium ion batteries.** In: *Journal of Power Sources* 288, S. 359–367. DOI: 10.1016/j.jpowsour.2015.04.081.

Guidance for data in publications

A checklist for Li-batteries process- and equipment parameters in publications

www.liplanet.eu
info@liplanet.eu