



Lithium-ion cell production
Basmati Workshop
Novel Nanomaterials for Energy & Printing
Applications
November, 23rd 2016

H.-Y. Amanieu (Leclanché GmbH, Willstätt, Germany)

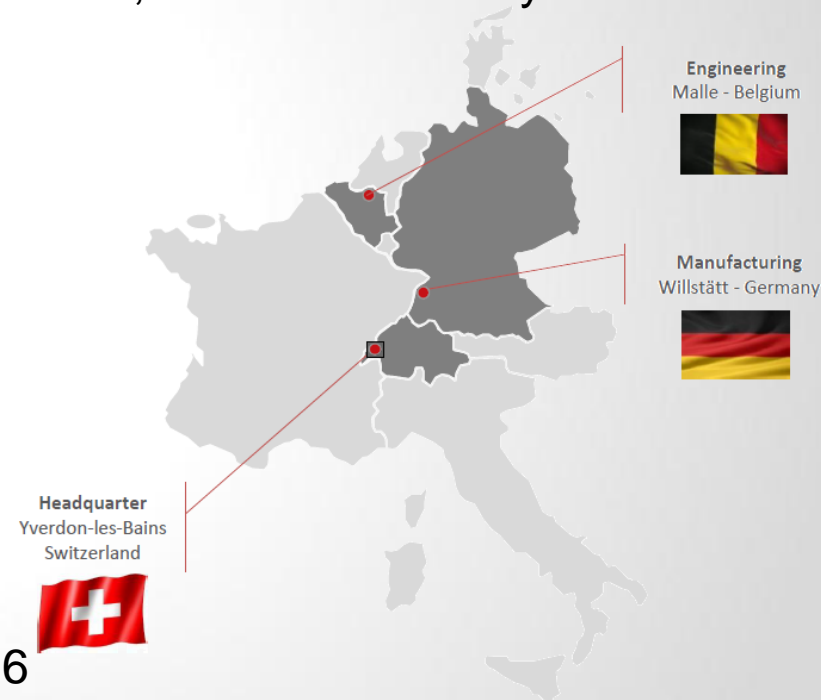
Outline



- I. Leclanché Group**
- II. Our market and strategy**
- III. Production line (Germany)**

Continuous innovation in Energy Battery Storage System since 1909

- Founded in 1909 after the name of G. Leclanché, inventor of the dry cell
- Headquarters in Switzerland
- Listed on Swiss Stock Exchange: LECN
- More than 100 patents in Lithium-Ion-cells
- Fully industrialized battery supplier
- Mass production facility in Germany
- 160 full time employees
- ISO 9001, ISO 14001 accreditation by 2016



Leclanché Group



“SA”, Yverdon, Switzerland: headquarters

- Administration and transversal activities
- Module production pilot line



“GmbH”, Willstätt, Germany: cell production

- Installed production capacity of ~100MWh/year (dependent on mix of cells produced)
- Automated production line
- R&D (electrochemistry)
- ISO 9001:2000

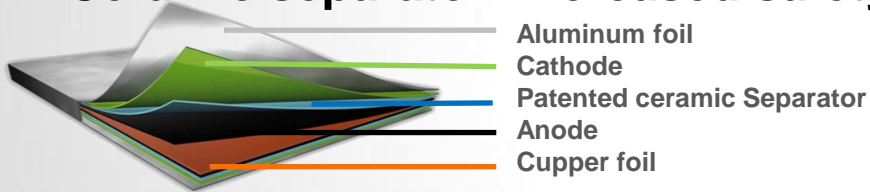


“BVBA”, Turnhout, Belgium: engineering

- R&D (system):
Hardware & Software for modules and energy systems

Core technologies:

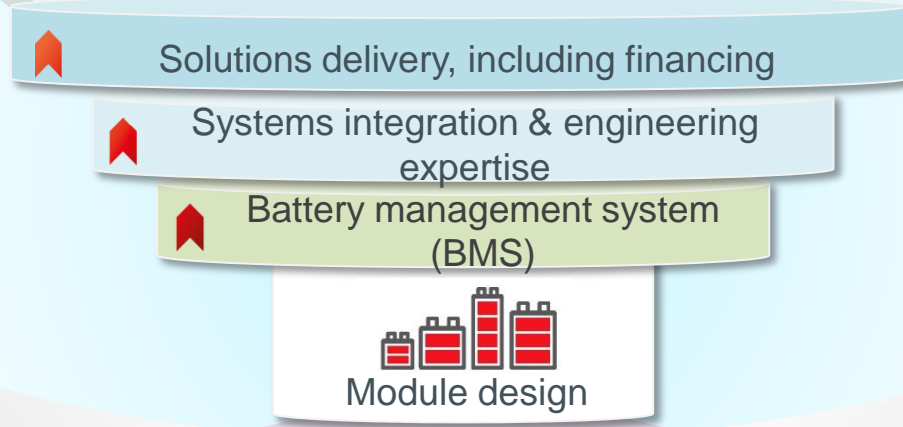
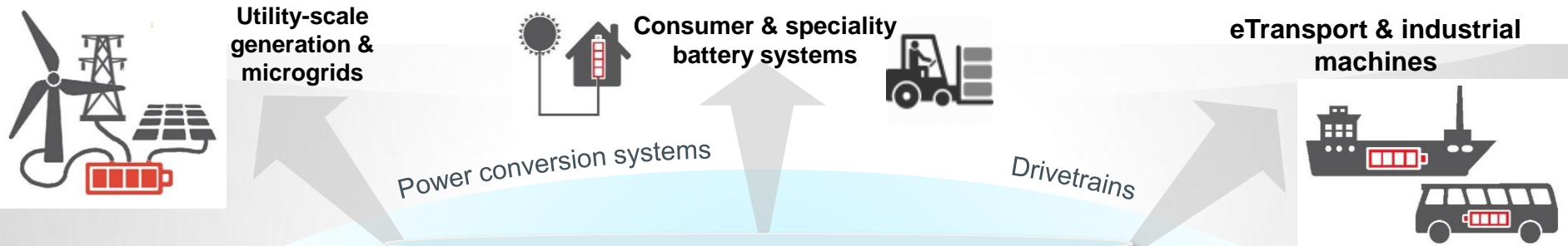
- **Lithium Titanate-based cells: > 15 000 cycles, > 10 years, high power & safety**
- **Graphite/NMC-based cells: > 4000 cycles, high density 160 Wh/kg**
- **Water-based manufacturing: no toxic solvent, cost effective**
- **Ceramic separator: increased safety in operation**




Our markets and strategy

Vertical integration


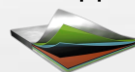

Asset management & control software




Proprietary Lithium Titanate Oxide (LTO) cells for leading performance in long-life and rapid-charge applications



Proprietary G-NMC* cells for energy intensive applications



Third party battery cells and other energy storage technologies



*Graphite anode and Nickel-Manganese-Cobalt cathode

Our markets and strategy

Stationary: electricity supply | grid or off-grid



Mobility: transportation and heavy machinery



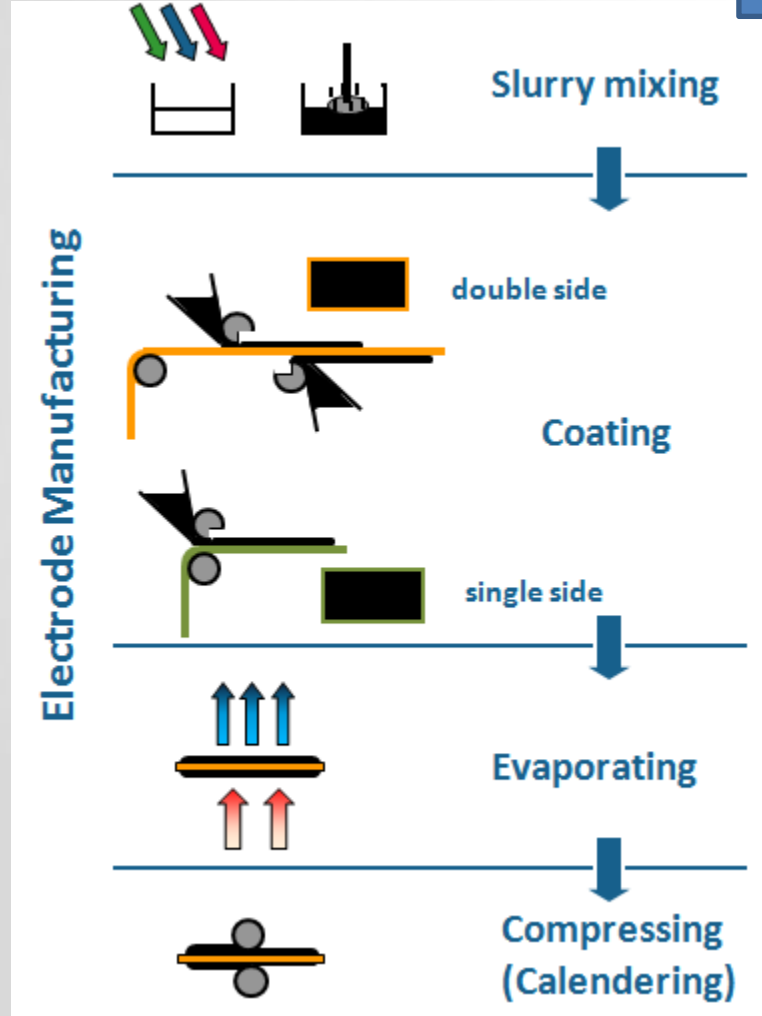
Speciality Battery Systems: bespoke battery packs



Overview



material in-/output



- + Active material
- + Binders
- + Additives
- + Solvents

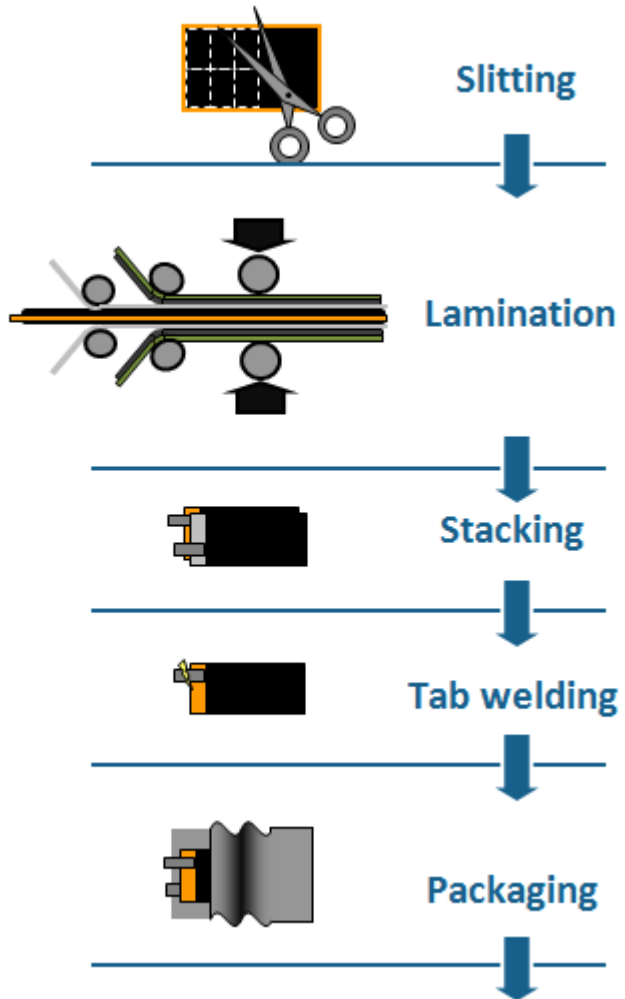
- + Al electrode foil
- + Cu electrode foil

- Solvent (water) emission



Overview

Cell assembly



material in-/output

- Cutting scrap Al foil
- Cutting scrap Cu foil

- + Separator
- Carrier foil

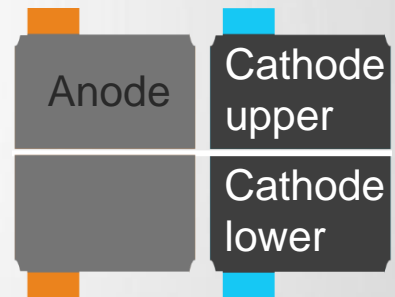
- + Adhesive tapes

- + Al tabs (positive)
- + Ni/Cu tabs (negative)

- + Pouch foil (PET/ Aluminum laminate)



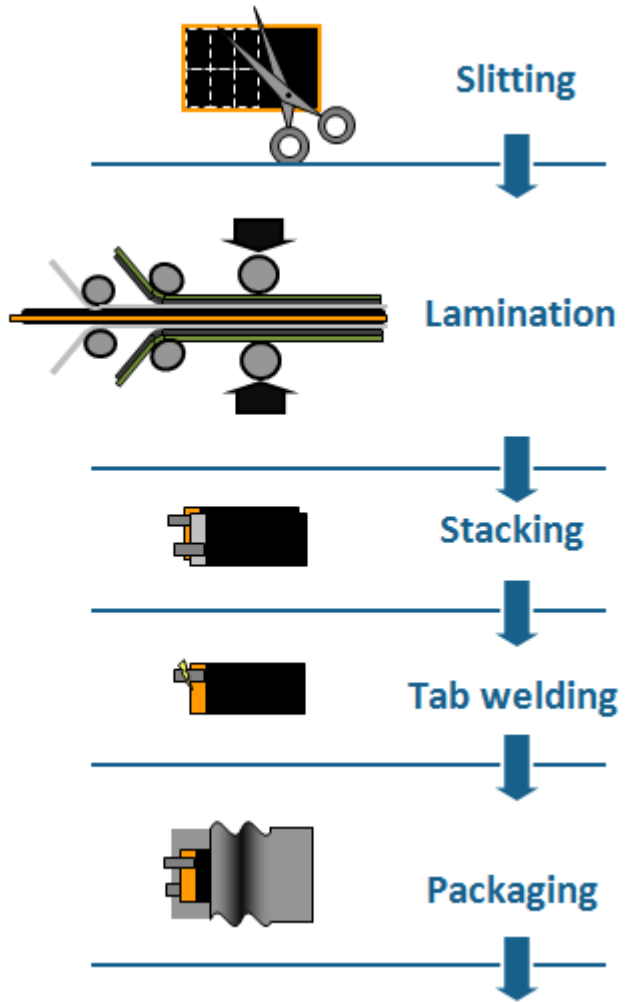
VIDEO



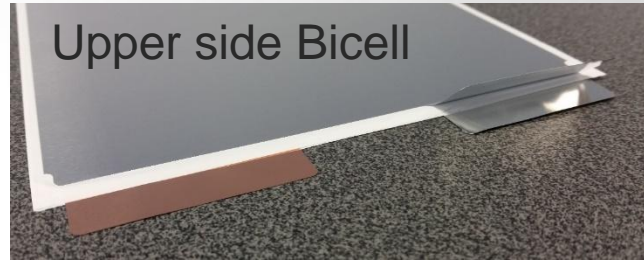
Overview

material in-/output

Cell assembly

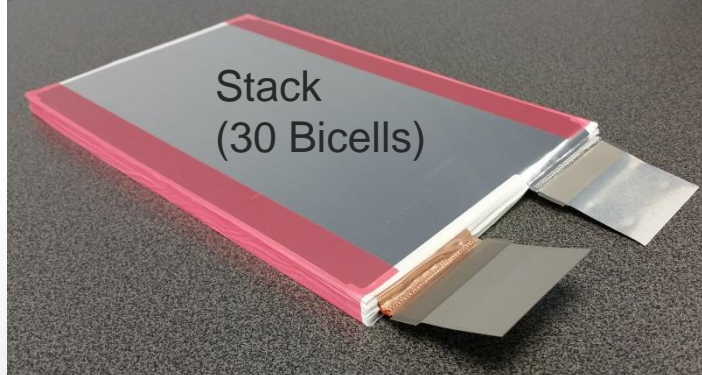


- Cutting scrap Al foil
- Cutting scrap Cu foil
- + Separator
- Carrier foil
- + Adhesive tapes
- + Al tabs (positive)
- + Ni/Cu tabs (negative)
- + Pouch foil (PET/ Aluminum laminate)



Upper side Bicell

VIDEO

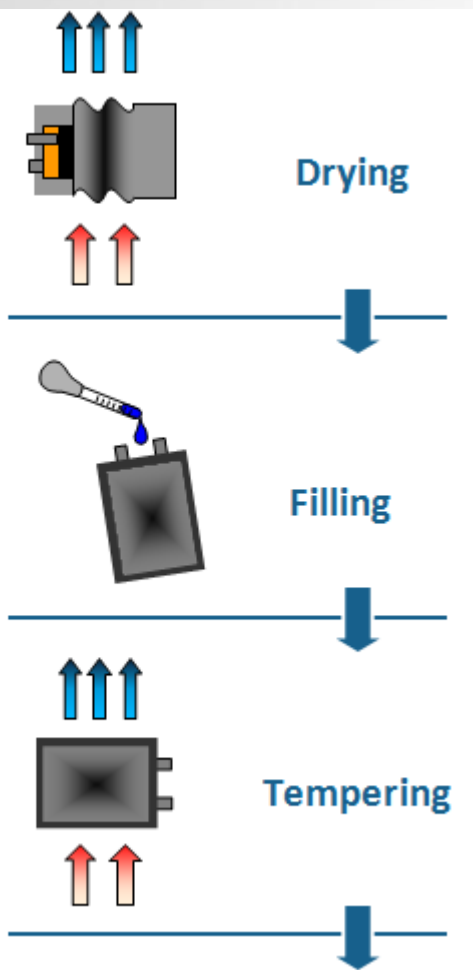


Stack (30 Bicells)

Overview



Cell assembly



material in-/output

- Solvent (water) emission

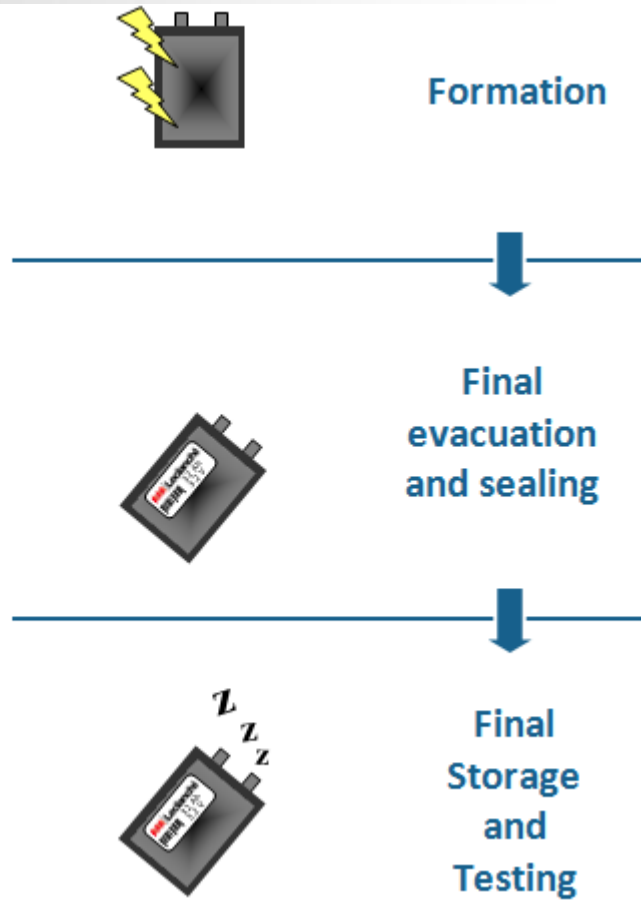
+ Electrolyte



Overview

material in-/output

Electrical formation
(system dependent)



- Cutting scrap from pouch foil



Summary

- Mass production of large-format lithium-ion cells means: Sophisticated product features and very low manufacturing tolerances on many levels
- Different professionals from a variety of topics has to cooperate in an interdisciplinary way
- If the production of Lithium-ion cells should be increased continuously fully automated processes play a decisive role
- Manual interventions in the production process should be avoided as far as possible
- Because of the high precursor costs the minimization of waste during process is another key role with respect to success of the plant



**Thank you
for your attention**

Aknowledgement: Dr. Julian Fischer for the “virtual tour”