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TÜBİTAK
RUTE

# TÜBİTAK Rail Transport Technologies Institute (RTTI)

## Energy Storage Systems Division

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- TÜBİTAK Rail Transport Technologies Institute (RTTI)


- Türkiye
- Energy Storage Systems Division in the institute
- Pilot-scale battery cell production: synthesis of active materials, roll-to-roll electrode production and pouch or prismatic cell assembly
- Battery module and package development
- Battery management system development
- The most comprehensive battery cell development and testing infrastructure in Turkey


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The calls we are interested in:

- HORIZON-CL5-2023-D2-01-01: Technologies for sustainable, cost-efficient and low carbon footprint downstream processing & production of battery-grade materials (Batt4EU Partnership)
- HORIZON-CL5-2023-D2-02-01: Advanced materials and cells development enabling large-scale production of Gen4 solid-state batteries for mobility applications (Batt4EU Partnership)
- HORIZON-CL5-2023-D2-02-02: New Approaches to Develop Enhanced Safety Materials for Gen 3 Li-Ion Batteries for Mobility Applications (Batt4EU Partnership)

# Previous Projects

| | | | |
|---|---|---|---|
| High-pErformance moduLar battery packs for sustaInable urban electrOmobility Services (HELIOS) | EU-Horizon 2020 Project Partner | 2021-2024 | The HELIOS project aims at developing and integrating innovative materials, designs, technologies and processes to create a new concept of smart, modular and scalable battery pack for a wide range of electric vehicles used in urban electromobility services, from mid-size electric vehicles to electric buses, with improved performance, energy density, safety, lifetime and LCoS (Levelized Cost of Storage). In Helios, role of RUTE is develop hybrid battery module architecture containing two different cell types. |
| Research-to-Adoption of Next Generation Li-ion Batteries for Electric Vehicle Applications | TÜBİTAK- International Fellowship for Outstanding Researchers Programme | 2020-2023 | Li-rich and Ni rich layered-layered cathode active materials known with $Li_2MnO_3$-$LiMO_2$ nomenclature, high nickel NMC and Si, Sn and Li based composite anode active materials will be investigated as cathode and anode materials, respectively. Along with a promising cycle life, it is the ultimate aim of this proposal to achieve 800Wh/L energy density with a fast charging capability which can provide 80% state of charge in 20 minutes. |
| Development of lithium-ion battery for satellites | Turkish Republic State Planning Organization | 2014-2021 | To develop a battery prototype for space qualification. Project management and execution of all tasks and activities in the work packages |
| Prototype BEV conversion | TÜBİTAK | 2017-2019 | To convert a conventional vehicle to BEV with 21.5 kWh battery pack/ Project management and execution of all tasks and activities in the work packages |
| Establishment of Automotive excellence centre | Turkish Republic State Planning Organization | 2015-2019 | To establish a centre including R&D laboratories and workshops/ Project management and execution of all tasks and activities in the work packages |
| COST-Development of Cathode Active Material for Lithium-ion Batteries | EU-COST | 2011-2014 | To develop nanostructured LFP as cathode active material/ Project partner |

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# Research Focus on Energy Storage Division in RUTE

**Improvements in manufacturing processes and recovery of active materials**

- Roll-to-roll manufacturing method of aqueous-processed thick NMC532 electrodes for lithium-ion batteries
- One Step Re-Generation of Lithium Metal Oxide Based Cathodes from dead LCO and NMC commercial cells

**Non-active components within battery cell**

- Anode-less Lithium Ion Battery Technology @ TRL 3 & 4
- 3D self-standing scaffolds as current collecters

**Active Material Development**

- High voltage cathode material and electrolyte developments at TRL 5&6
- 2D materials-based anode and cathode materials for lithium-ion batteries and ultra capacitors
- Porous and amorphous carbon additive and coating strategies for next-gen anode materials (Si/Graphite anodes)
- Active materials for for next-generation Na-ion batteries

# Traditional Manufacturing Process

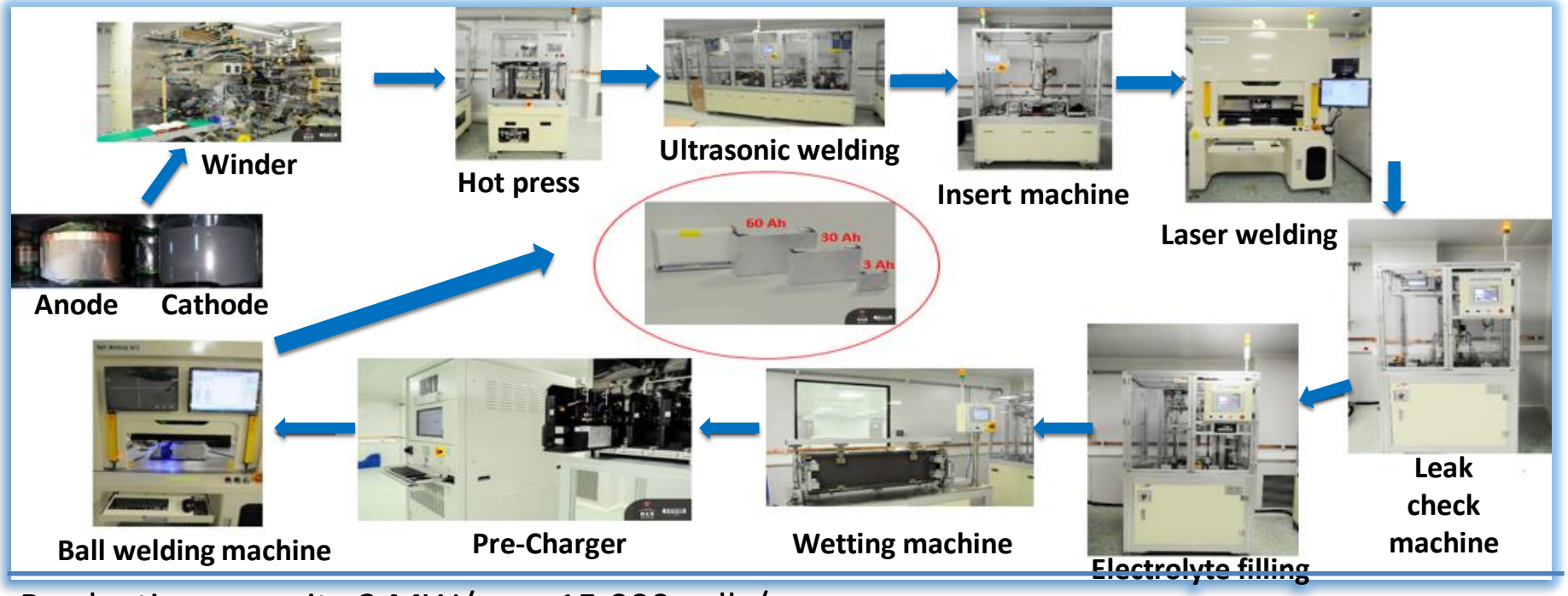
Slurry → Coating → Calendaring → Zigzag or Winder

Stack Forming

Welding

Pouch or Prismatic Cells

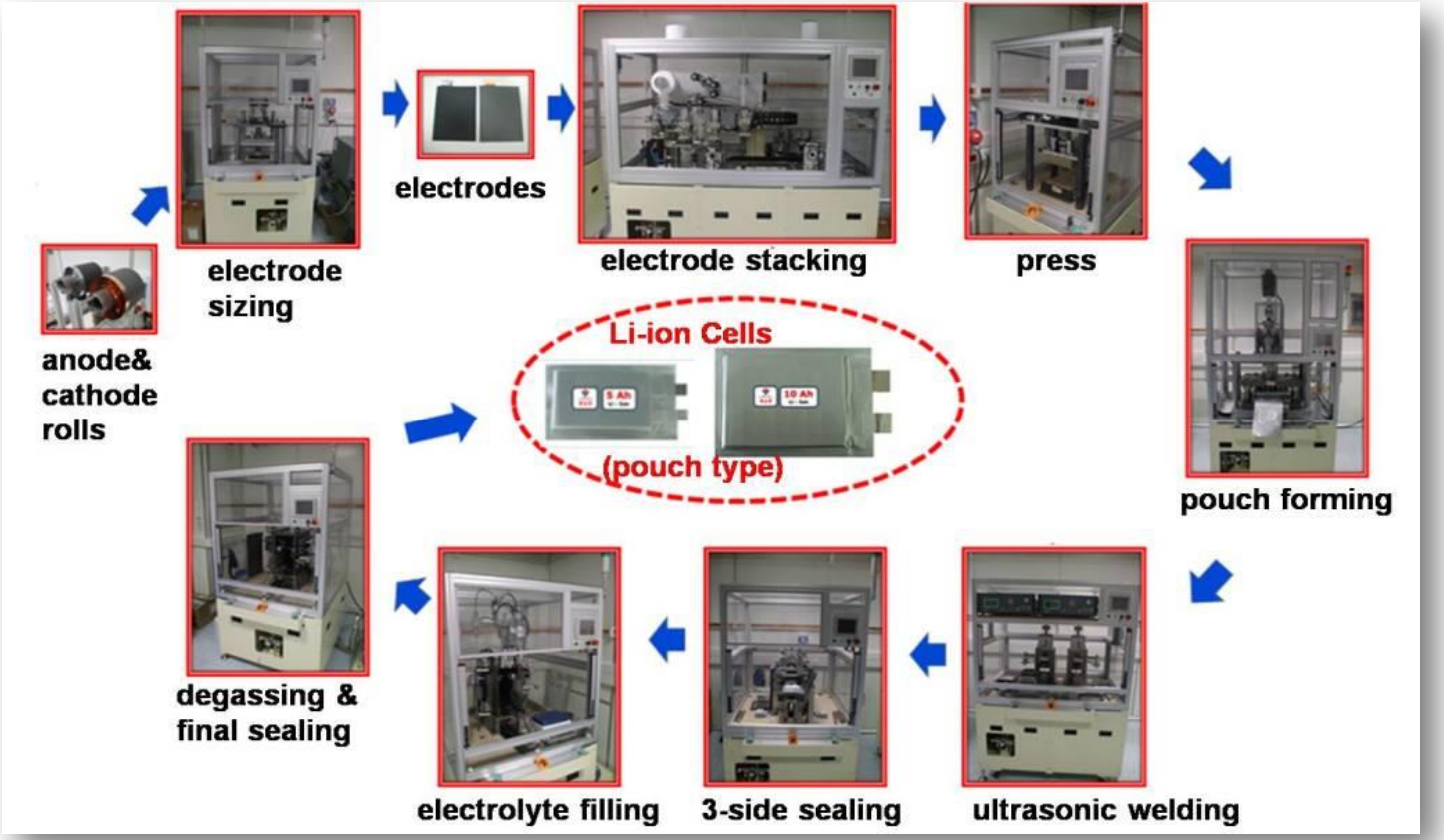
# Prismatic Li-ion Cell Production Line




Production capacity 3 MW/year 15.000 cells/year

Located in 320 $m^2$ dry room

# Pouch Li-ion Cell Production Line



# Test Infrastructure

**ITOCHU:** Cell Safety Tests

- ✓ Nail penetration,
- ✓ Crush,
- ✓ Short circuit,
- ✓ Impact Test


**LAZZERO:** Leakage test system with helium Leakage detector

It measure helium leakage with $10^{-9}$ $Pa \cdot m^3.s^{-1}$ ($10^{-8}$ mbar.L. $s^{-1}$) precision test system


**NANOVAK:** Leak Vacuum Test System

Measurable at 30x30x35 cm dimensions prismatic cells, 1-$10^{-6}$ mbar range adjustable vacuum. It can detect electrolyte leakage on cell case

**ESPEC:** Climatic Chamber

Temp Range: (-70)°C-(+180)°C

Heat/Cold Speed: 15,5°C/min

Humidity Range: %10 - %95


**NÜVE:** Climatic Chamber

Temp Range : (-40)°C - (+150)°C

Humidity Range : % 10 - % 98