

Li-ion pouch cells instrumentation and monitoring



POLITECNICO DI TORINO

Politecnico di Torino

Department of Mechanical and Aerospace Engineering (DIMEAS)

ScuDo – XXXII cycle

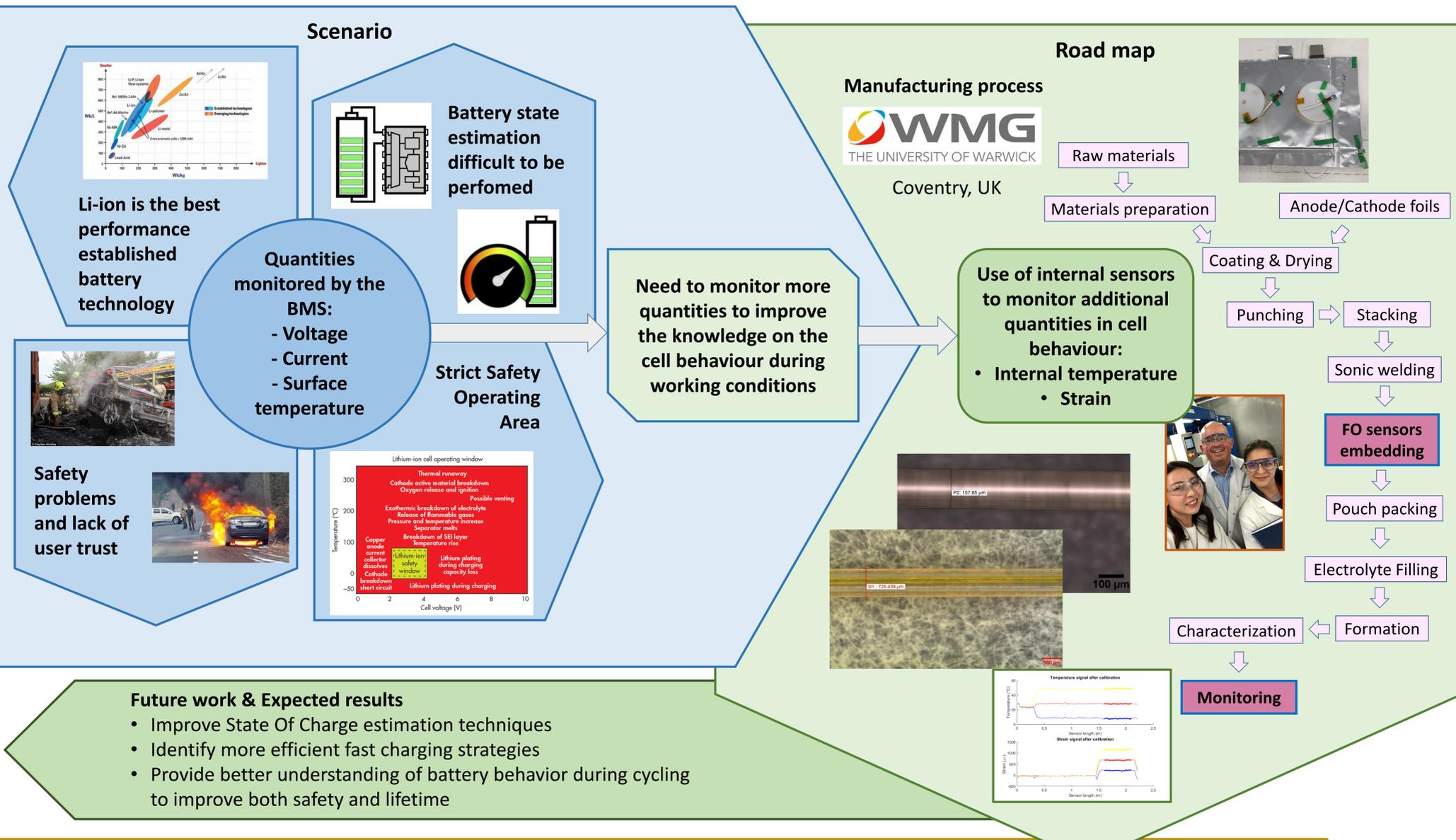
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Candidate: **Elena Vergori**

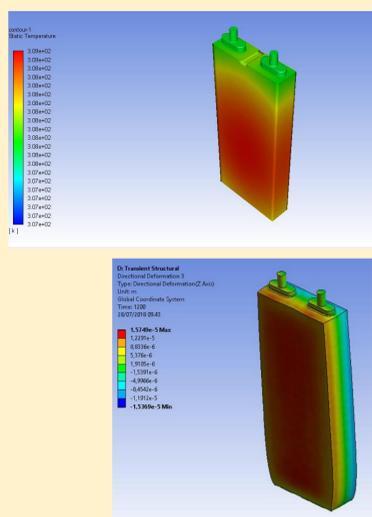
Supervisor: Prof. **Aurelio Somà**



Batteries are the main limitation in Electric Vehicles (EVs) spread due to their limited capacity, lifetime, cost and safety. Among the battery technologies established on the market, the major focus is on Li-ion cells because of their better performance in terms of energy and power density. To guarantee the best working conditions, voltage, current and temperature of the single cells are handled by an electronic unit called Battery Management System (BMS). Moreover various estimation algorithms are implemented on the BMS to evaluate the state of the battery.

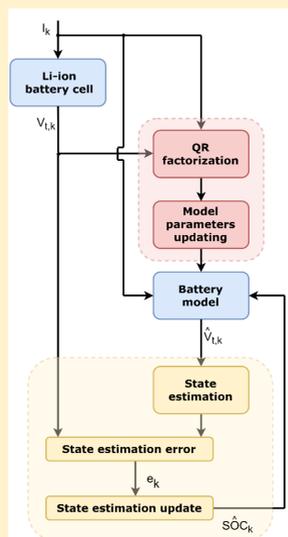


Other Activities



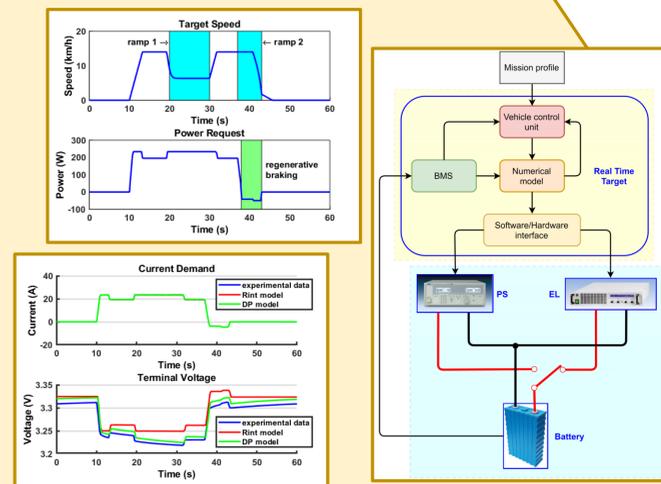
Battery Thermo-Mechanical modelling activity

Knowing cells temperature distribution is fundamental to properly design a battery module. Uniform temperature should be guaranteed among the various cells in order to have the similar degradation and performance. Modelling is a useful tool in this process, especially in a multiphysics system such as a battery. Induced thermal strain can also be evaluated.



EVs onboard SOC algorithms exploration

To provide information on the battery state, estimation algorithms are implemented in the BMS. The exploration of the state of the art of simplified electric battery models for electric vehicles applications and of the main State Of Charge (SOC) algorithms used in EVs was carried out.



Battery Testing activity and Simulation

Using a programmable testing equipment and a proper control software, various loading cycles are applied to battery cells to simulate different working scenarios.

Papers

- F. Mocera, E. Vergori, 2017. Study and identification of the thermo-electric behavior of lithium-ion batteries for electric vehicles, AIAS 2017, Pisa.
- E. Vergori, F. Mocera, A. Somà, 2017. Battery modeling and simulation using a programmable testing equipment, CEEC 2017, Colchester.
- F. Mocera, E. Vergori, A. Somà, 2018. Study of battery performance with Hardware In the Loop simulation of a working vehicle. EVER 2018, Monte-Carlo.
- E. Vergori, F. Mocera, 2018. Simulation of the thermo-mechanical behavior of prismatic Li-ion cells. AIAS 2018, Villa San Giovanni (RC).
- E. Vergori, F. Mocera, A. Somà, 2018. Battery Modelling and Simulation Using a Programmable Testing Equipment. Computers, 7(2), 20.
- F. Mocera, E. Vergori, 2018. Study and identification of the thermo-electric behavior of lithium-ion batteries for electric vehicles. Procedia Structural Integrity, 8, 126-136.

Courses

- The measurement of electrical impedance (2 CFU)
- Techniques of robust control (6 CFU)
- Structural Health Monitoring using Machine Learning (4 CFU)
- Progettazione e simulazione eterogenea con tecniche di «System Engineering» (4 CFU)
- Sviluppo e gestione di sistemi di acquisizione dati (5 CFU)
- Writing Scientific Papers in English (3 CFU)
- Lean startup e lean business for innovation management (4 CFU)