Promoting fire safety in innovating design of electric vehicles : the example of the EU-funded DEMOBASE project

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ABSTRACT

This paper describes the way fire safety is handled in a recently EU H2020 funded 3 years on-going project federated by SAFT named DEMOBASE [1] with 10 other partners jointly working on an innovating EV concept based on a Li-ion battery pack and targeting demanding criteria of electrical vehicle emerging market in terms of cost, time to market and safety.

INTRODUCTION

Recent policies put in place at EU level and worldwide to favour alternative energies for transportation, responsible for a major part of greenhouse gas emissions have resulted in increasing efforts of major automotive stakeholders to promote innovative EVs. The success will rely on the promotion of new EVs no more suffering of major drawbacks of early EV generation like limited performance, high cost and -although not yet really measurable- (fire) safety concerns. Fire safety has been essentially rated as an open issue so far because of the energy storage system, that is to say to the lithium-ion battery pack which is equipping currently most commercially available electric vehicles, and potentially facing the so-called thermal runaway hazard (see fig. 1).

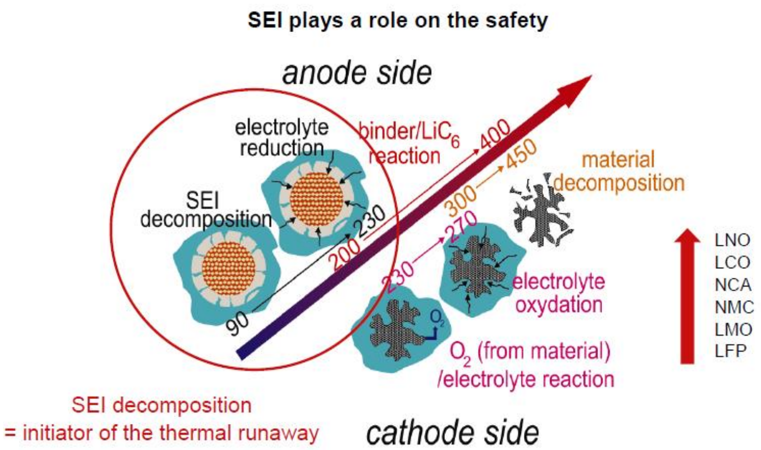

Fig. 1: underpinning phenomena in the process of thermal runaway of a li-ion cell according to chemistry (adapted from ref.[2])

In the context of the DEMOBASE project (DEsign and MOdelling for improved BAttery Safety and Efficiency) aiming at developing an innovating EV concept meeting new market demand, the 11 members of the consortium are currently jointly implementing a more holistic approach to consider safety of the battery pack in the context of its intended use in an EV: safety is indeed as a key aspect of an innovating EV, in which all parts may play a role for their inherently safer design.

METHOD AND RESULTS

As a matter of fact, promoting performance will rely of high density energy battery packs for which the control of the thermal runaway risk will have to be carefully and smartly handled. However, the achievement of the safety target of innovative EV requires to consider all -sometimes underscored- aspects of the key underpinning supply chains allowing for the concept of an innovating efficient low cost and safe-to-use EV.

The strategy followed in the DEMOBASE project has placed safety including fire safety as a central but also cross-cutting domain of all supply chain supporting the envisaged EV development (see figure 2)

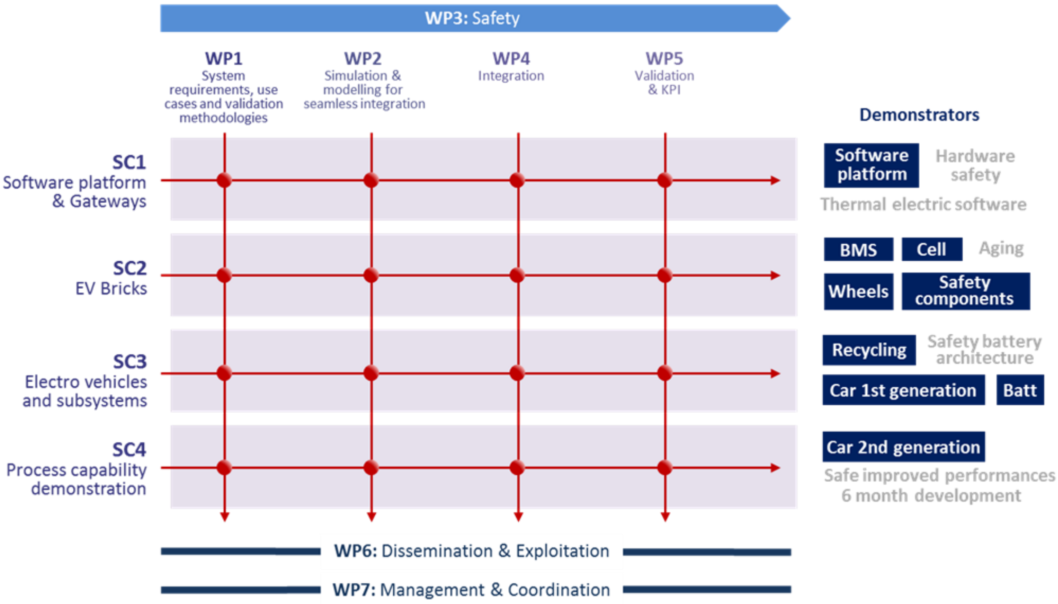

Fig. 2: safety dedicated work (WP3) as positioned in the overall structure of the DEMOBASE project

The strategy encompasses notably: a)integrating safety aspects at early stages of EV design, where the maximum flexibility still exist to solve safety issue at lowest cost and smartest manner b) proceed to early preliminary risk analysis with interactive contribution of all stakeholders on the full value chain, including end of use recycling of the EV c) ensure appropriate mechanical properties of the chassis with regard to preserving battery pack integrity in case of a crash, d) consider reaction to fire of key combustible parts, including li-ion cell packaging and global pack casing ; e) consider any potential disturbance at level of pack that might issue from electromagnetic field induced by the electrical engines and power train ; f) define prevention measures and/or evaluate consequences of an EV fire as to promote protection of people in all requested configurations and contexts (normal use, parking, repair, emergency situations, extraordinary situation like hurricane, accidental contact with water).

The strategy is also of course supported by state-of-the art modelling work[3] and an experimental programme on Li-ion cells and modules and possibly also on other key components contributing to safety that will be determined and implemented according to a preliminary risk analysis work

CONCLUSIONS

The presentation will explain the fire safety strategy implemented in the DEMOBASE project in details together will results already obtained at the time of the conference including the key findings of the preliminary risk analysis undertaken under leadership of INERIS in a joint effort with the other key DEMOBASE stakeholders

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