Abstracts

Structured LIB Electrodes – from Concept to Production Process

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Although lithium-ion batteries (LIB) have reached enormous progress over the last years, a further increase of energy density and a reduction of costs are demanded to promote acceptance for substantial applications like electric vehicles. In this respect, solutions without compromising further properties like power density and cycling stability are requested.

Based on the choice of adequate active materials, an approach to effectively realize high energy electrodes and save costs at the same time is to apply very high coating thicknesses [1]. This strategy, however, causes reduced processability and rate capability of the corresponding electrodes [2,3].

By structuring the electrodes, these drawbacks can be mitigated. It has to be considered, however, that structuring often causes a partial loss of the energy density gained by thick coatings as well as additional production costs due to additional process steps. On the other hand, it can enable very large improvements in processability and rate capability.

In this contribution, different structuring concepts like perforation, hierarchically customized porosity, graded arrangement of active materials and a locally customized passive material structure and their implementation to production processes are described. The peculiarities of the respective processes are explained and finally, an assessment is given by weighing up the expense and the efficacy of each concept.

References

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Francesco Matteucci – European Innovation Council (EIC) “*An EIC perspective on Nanomaterials for Energy Lab to Fab process”*

EIC aims to be the one-stop-shop EU innovation agency enabling the transition to market of its deep tech innovations. After an EIC introduction, the under development EIC approach to facilitate funded projects on nanomaterials for energy Lab to Fab process will be discussed.

Mark S. Kozdras - NRCan (CA), Ole Martin Løvvik - SINTEF (NO) “*Casting Materials Acceleration Platform and the accelerated search for thermoelectric materials”*

Thermoelectric (TE) generators can contribute to energy harvesting and efficiency improvement by converting waste heat to electricity, but improved materials could enhance their potential impact significantly. An autonomous, or self-driving, laboratory, also known as a Materials Acceleration Platform (MAP) is under development in Canada, with the possibility to produce low cost, environmentally friendly TE materials in an automated fashion.

An automatic workflow for high-throughput search for thermoelectric materials has been developed in Norway. This includes prediction of the Seebeck coefficient, the electrical conductivity, and the thermal conductivity from first principles. Electron-phonon interactions and alloy scattering contributions can be added in a second stage of the screening. Results from the theoretical screening can be coupled to the MAP in Canada, providing efficient validation of the theoretical predictions.

Martine Mayne-L’Hermite and Mathieu Pinault - CEA (France) *“From vertically aligned carbon nanotube production to energy storage: story of a start-up and join laboratory”*

Vertically aligned carbon nanotube carpets (VACNT) are most often forming macroscopic samples which make them promising as new multifunctional materials for a variety of potential applications such as filters, electrodes for supercapacitors, composites for aeronautic…Such interest absolutely requires the reproducible production of various well controlled VACNT carpets in terms of purity, size and surface chemistry, as well as their controlled processing.

Among applications, energy storage is an effective field of commercialization. Indeed, VACNT based electrodes for supercapacitors exhibit considerable interesting properties enabling the production of new generation supercapacitors.

During this communication, we will present our scientific and technical approach to gain maturity for the continuous synthesis of such VACNT and for the development of corresponding electrodes. Subsequently, we will emphasize on the different challenges to reach the creation of a start-up, and describe the different steps including a join laboratory operated together by academic partners and the created company.

Elicia Maine – Simon Fraser University (CA) ***"Accelerating advanced materials commercialization"***

As more multinational chemical and materials firms move to open innovation models, advanced materials ventures, often spun out of universities, are of increasing importance to creating and commercializing new materials and processes. These ventures are typically focused on breakthrough technologies that provide a window on innovation for the large multinational firms. Yet, such ventures face daunting challenges in their route from lab to market. Advanced materials innovations, underlying new product development across many industries (such as energy generation, energy storage, water treatment, transportation, and biomedical devices) typically take 5-15 years from invention to commercial product. Although advanced materials innovation enables broad value creation across many sectors of the economy, these long commercialization timelines, coupled with high capital investment and sustained uncertainty, deter investment. Drawing on observation and analysis of over 100 advanced materials ventures, strategies and policies are proposed which can reduce technical and market risks and accelerate advanced materials commercialization. This presentation draws on a paper published in Nature Materials. entitled "Accelerating Advanced Materials Commercialization" which can be accessed here.

Roberto Giannantonio – Università degli Studi di Milano (Italy) "*Organizational aspects of the Technological Innovation Process*"

The Technological Innovation Process engages a plurality of stakeholders that should properly interact in order to provide a smooth pathway linking knowledge, know-how and technology to the market, which is where the above assets are turned into socio-economic value.

Following a 20-years experience, also in the role of Corporate R&D Manager, within a highly innovative group whose core process is Technological Innovation and a further 10-years experience, mainly in the role of Innovation Manager, within public research centres, some conclusions may be stated and recommendations may be made in order to improve the performance of the Innovation Process.

In particular, also taking into account the increasing complexity of the global environment where Innovation takes place, some key organizational aspects may be highlighted.

Eva Petursson - HYBRIT. SSAB (SE) *"A new revolutionary steelmaking technology*"

In 2016, SSAB, LKAB (Europe's largest iron ore producer) and Vattenfall (one of Europe's largest energy companies) joined forces to create HYBRIT – an initiative that endeavors to revolutionize steelmaking. Using HYBRIT technology, SSAB aims to replace coking coal, traditionally needed for ore-based steelmaking, with fossil-free electricity and hydrogen. The result will be the world's first fossil-free steelmaking technology, with virtually no carbon footprint. Our goal is to reduce Sweden's CO2 emissions by 10% and Finland's by 7%.

Joachim Antonissen- Guaranteed (NL) "*Born from Innovation, Raised in Industry*"

Mid 2019 a new company, Guaranteed B.V., was created by ArcelorMittal, OCAS and Finindus to provide one-stop shop XXXL metal additive manufacturing part production and repair services to a variety of different heavy industry sectors such as energy, oil & gas, steel, mining, aerospace, … This presentation will provide a first-row experience on how to merge tools and concepts which originated from research & development with the challenges of an industrial production environment, while respecting economical constraints. At the same time, the talk will also focus on providing examples of the synergies that arise from bringing these elements together.

Tomi Lindroos, VTT (FI) "*From powder to product - Piloting case study additive manufacturing of topology optimized electromechanical components*"

Electrification and especially electric mobility (e-mobility) set new demand for more optimized electromechanical devices with enhanced performance, lower material consumption and life cycle cost. This demand is pushing the manufacturers and research community to explore non-conventional designs and manufacturing methods. Additive manufacturing technologies are opening up new possibilities for realizing novel magnetic circuit designs. Studies have shown that by tailoring material compositions together with optimized processing parameters and particularly, with post-treatments, high performance soft magnetic components can be manufactured by additive manufacturing. Further, it has been shown that through topology optimization, the weight of an electrical machine can be decreased significantly without compromising the other key characteristics. We demonstrate a manufacturing route where the restrictions of conventional manufacturing methods do not apply enabling ground-breaking changes in designs and consequently leading to lightweight and material efficient solutions for, e.g., future e-mobility.