Applications Panel Abstract & Speaker Biography

Lithium Sulfur Application in Automotive

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To date the majority of automotive Hybrid Electric Vehicles (HEV) and Battery Electric Vehicles (BEV) utilise Lithium Ion battery technology. Lithium Ion cell chemistry has and continues to improve, allowing the storage capacity of such batteries to increase, translating into improvements in terms of vehicle range. Lithium Sulfur (Li-S) chemistry offers a potential step-change in terms of energy density which would support electric vehicles with greater range than previously possible and at a lower price-point.

The REVB (Revolutionary Electric Vehicle Battery) project, a collaboration between Ricardo, Imperial College London, Cranfield University & OXIS Energy, seeks to advance the design and comprehension of Lithium Sulfur cell technology and understand how it can be applied in an automotive context. Ricardo's work has included design & construction of modules composed of 24 cells (where several modules could be arranged to create an HV battery) and the development of both hardware and software to support the control of Li-S cells. The project receives funding from Innovate UK and is due to complete in April 2017.

This paper begins by examining where Li-S batteries naturally fit within the automotive ecosystem, based on current expectations in terms of power & energy density, considering what vehicle types might be the most appropriate first adopters for the technology. The paper will show a number of different schemes which were evaluated from the perspective of mechanical design, thermal efficiency and manufacturing feasibility.

Ricardo has used its in-house VECTIS software to perform a Conjugate Heat Transfer analysis. This analysis solves both the coolant flow and interfacial heat transfer, providing an estimate of the cell temperatures. For this task, a novel simulation technique was developed to predict the cells' heat generation. Several concepts have been evaluated, and the analysis results have been used to optimise the final coolant system design.

From the testing and analysis of the cell design used for REVB there is clear evidence that the electrical & thermal behaviour of Li-S cells is significantly different from Lithium Ion, and as such a revised approach to management of the cells will be required in order to prevent abuse and ensure longevity. Ricardo has developed a new Battery Management System (BMS) to maximise the usage potential of Li-S. To implement the necessary model based control techniques, Ricardo has designed a new hardware solution featuring multiple processor cores and an integrated operating system for parallel processing of data. As a key technology enabler for Li-S chemistries in an automotive application, the new BMS has been

optimised with simplification of hardware safety circuits by transferring some discrete hardware functionality to dedicated functionality within the micro-controller unit. The BMS serves as a platform for the implementation of computationally intensive Li-S control and estimation algorithms.

Speaker Biography:

To be added shortly.