



Chair's Introduction

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WMG, The University of Warwick

Session Sponsor:





Battery Safety and legislation – LCV 2019

Mike Richardson – Principal Consultant WMG Energy Innovation

Introduction to WMG

- Established in 1980
- University of Warwick department
- 600+ staff in 10 buildings
- Education in 7 countries
- Collaborative R&D with 1,000+ companies
- 1,400+ SME engagements
- Multi-disciplinary teams
- Annual programme of £100m



Energy Storage and Management (ESM)



- Fundamental Chemistry
- Process Scale-Up
- Battery Characterisation
- Cell to Module to Pack
- System Performance
- Re-use and Recycling



ESM Facilities: Energy Innovation Centre



Materials, Electrochemistry, Cell Manufacture

Materials Preparation

Electrode Coating

Cell Assembly

Assembly & Forensics

Pilot Line

Forensics

Cell, Module & Pack Test, 2nd Life

Cell Testing

Abuse Tests

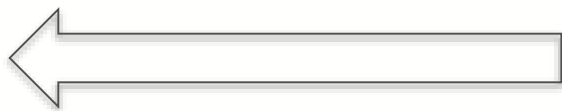
Electric Motors & Power Electronics

Design

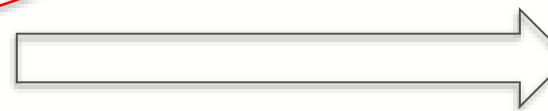
Materials

Manufacture

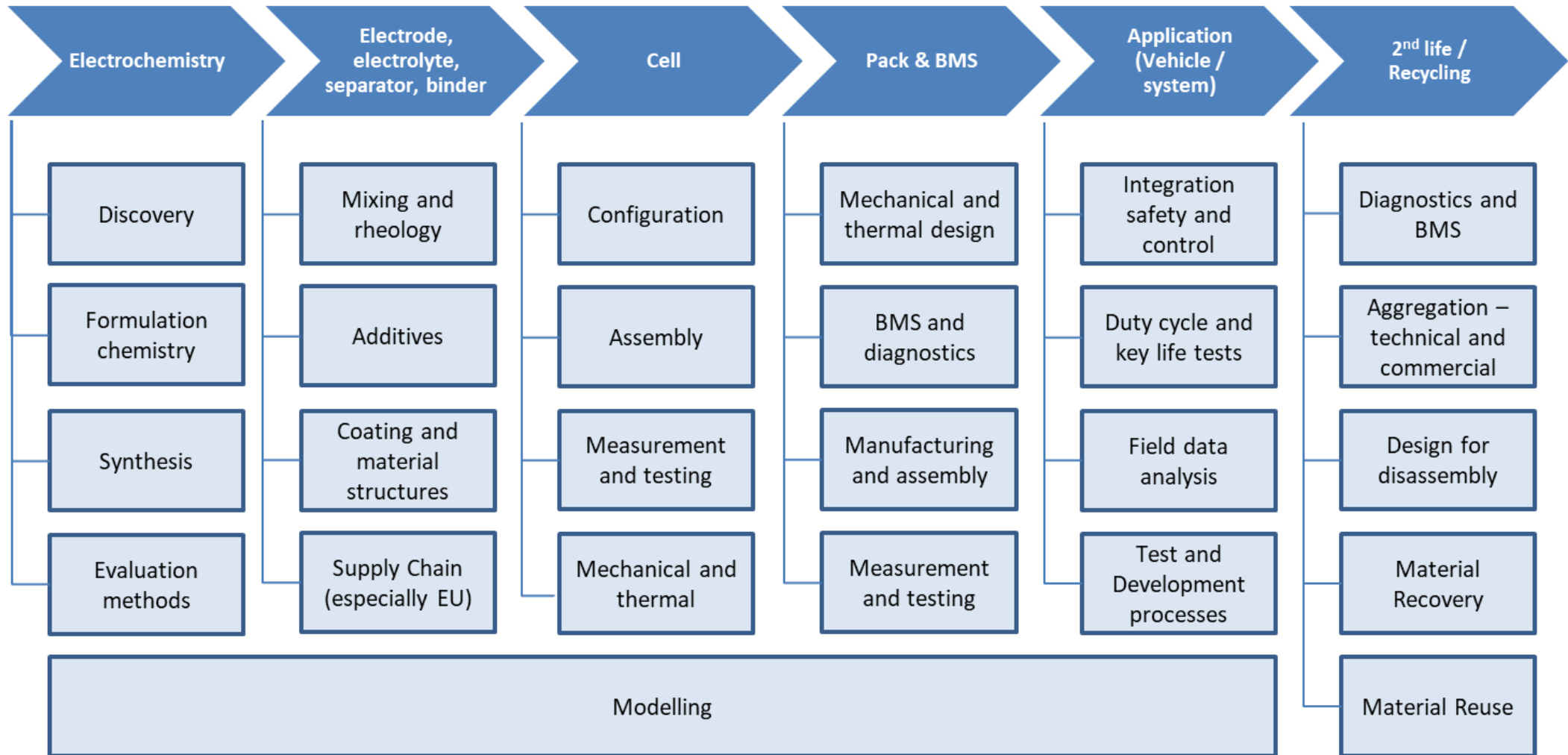
- High power / voltage
- SiC, GaN switching devices
- Whole system integration



Modelling and Simulation
Control systems and integration



Battery Research Challenges for WMG



Transport Electrification: Expected Battery Improvements by 2035

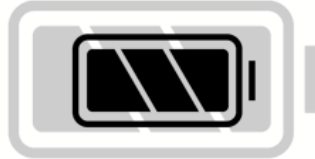
Cost



Now £98/kWh (cell)
£210/kWh (pack)

2035 £210/kWh (cell)
£75/kWh (pack)

Energy Density



Now 700Wh/l, 250Wh/kg
(cell)

2035 1400Wh/l,
500Wh/kg (cell)

Power Density



Now 3 kW/kg (pack)

2035 12 kW/kg (pack)

Safety



2035 eliminate thermal runaway at pack level to reduce pack complexity

1st Life



Now 8 years (pack)

2035 15 years (pack)*

Temperature



Now -20° to +60°C (cell)

2035 -40° to +80°C (cell)

Predictability



2035 full predictive models for performance and aging of battery

Recyclability



Now 10-50% (pack)

2035 95% (pack)

*Already achievable with Lithium Titanate

Battery Safety and legislation – Programme (Morning)

Session	Start	Finish	Presentation Title	Presenter	Organisation
1	09:30	09:50	Keynote - Battery safety from research to implementation	Professor David Greenwood	WMG
2	09:50	10:10	Safety across the whole EV lifecycle	Jonathan Buston	HSL
3	10:10	10:30	The UK's battery testing capability: Does the UK have enough... A gap analysis of the testing demands and current and projected supply.	Anna Wise	InnovateUK
Break	10:30	10:45	Break		
4	10:45	11:05	Battery Management Systems role in thermal runaway prevention/mitigation	Paul Faithfull	Potenza
5	11:05	11:25	The use of sensors to detect lithium ion cell venting events in EV batteries to allow preventative actions.	Neil Roberts	Amphenol Sensors
6	11:25	11:45	Brains for batteries: how intelligent, cell-level battery	Christoph Birkl	Brill Power
7	11:45	12:05	Battery design for maintainability, ruggedness and safety	Andrew Cowie	Denchi
Lunch	12:05	14:00	Lunch		

Battery Safety and legislation – Programme (Afternoon)

Session	Start	Finish	Presentation Title	Presenter	Organisation
8	14:00	14:10	Keynote - Towards legislation and standardisation for Lithium Ion Batteries	Tony Harper - Faraday Challenge Director	InnovateUK
	14:10	14:30	Safety considerations for battery manufacture	Tony Richardson	UKBIC
9	14:30	14:50	A review of battery safety for electric vehicles and their impact on developing materials	Rakesha Yedla / Brandon Bartling	3M
10	14:50	15:10	Predicting Thermal Runaway of Lithium Ion Batteries in Abuse Conditions with Potential for Fire and Explosions	Professor Jennifer Wen	Warwick Fire
11	15:10	15:30	Safety in Electric Vehicle and Battery Recycling	Dr Anwar Sattar	WMG
Break	15:30	15:45	Break		
12	15:45	16:05	Fire suppression and management for Lithium Ion Batteries	Gordon Forbes	Lifeline
13	16:05	16:25	Practical considerations for fire management of Lithium Ion Batteries	Jeff Ansell	Bureau Veritas Fire Science Department
14	16:25	16:45	Battery transportation and safe packaging.	Mike Valentine & Stuart Rose	Tri-Wall
15	16:45	17:05	Circular Economy Perspectives for the Management of Batteries used in Electric Vehicles	Nikolas Hill	Ricardo Energy and Environment
16	17:05	17:15	Next steps in UK Research for Lithium Ion Battery Safety [From Pre-LIBS to LIBRIS]	Marion Randall - 3M Paul Haney - JLR	3M and JLR

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