

# MANUFACTURING

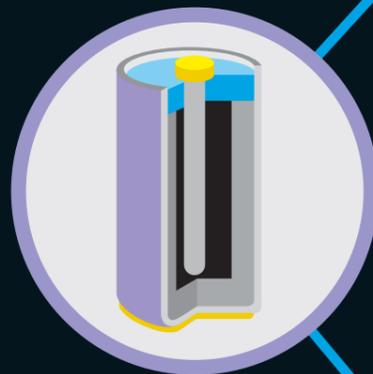
## RAW MATERIAL



Identifying critical parameters, such as material properties and formulation methods that influence cell performance

Measuring purity of materials used in manufacture, including materials recovered from recycling, and establishing a definition of 'battery grade'

## BATTERY CELL



Standardisation of terminology between cells, modules and packs, including best practice measurement protocols and configurations

Standardisation of test and characterisation methods and validation at the materials and cell level

Determination of state of charge and state of health, including derived parameters that cannot be directly measured

# IN SERVICE

## BATTERIES FOR TRANSPORT

In situ temperature measurement to support improved thermal management strategies



Identifying failed or failing cells within a battery module or pack and understanding the impact of individual cell failure on overall performance

Coupling of methods for simulation and use of data, including the need for data sharing and benchmarking



Characterisation of degradation mechanisms linked to actual car use to reduce the need for over-sizing

Establishing test protocols to take into account different types of use, for example, fast charging

Non-invasive monitoring of state of health and establishing which parameters are most relevant to industry and the end user

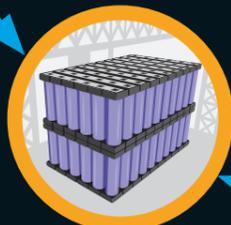
Standardisation of electrochemical test methods, for example impedance spectroscopy for state of health monitoring



## BATTERIES FOR GRID MANAGEMENT

Accelerated stress tests to establish confidence in lifetime prediction, including external verification and validation

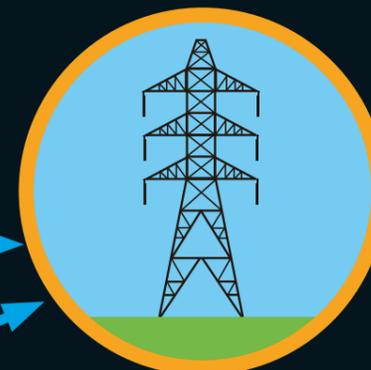
New techniques for post mortem analysis in order to identify failure mechanisms and inform cell design



Understanding propagation of damage as a result of failed cells within a battery module or pack



Measurement of electricity use during the day to inform grid usage for recharging electric vehicles



# ENERGY TRANSITION

## Measurement needs within the battery industry

# END-OF-LIFE

## RE-USE AND SECOND LIFE



Life cycle analysis and economics for the design and manufacturing process to better understand scenarios and processes for recycling

Identifying end-of-life thresholds for first and second use, including economics and safety

## RECYCLE



Detection and recovery of recycled metals, including identification and specification of the most critical materials

## DISPOSAL



Monitoring environmental effects throughout the life cycle from extraction of raw materials to recycling and disposal of the battery