



TOGETHER,  
**WE HAVE THE POWER**  
TO GENERATE A  
CLEANER FUTURE.



**Gas supply and technical support  
for lithium-ion battery production**

GENERATING A CLEANER FUTURE

# THE POWER TO REDUCE COSTS, INCREASE EFFICIENCY AND IMPROVE SUSTAINABILITY.



As a world-leading industrial gas supplier, Air Products works with battery cell manufacturers and cell recyclers to provide high quality gases, advanced applications technologies and services to meet your volume and purity needs.

Our team of experts also provides on-site process and technical support, including gas equipment safety inspection and training, to help:

- Reduce cost
- Increase productivity
- Improve product quality
- Improve on-site safety
- Reduce your CO<sub>2</sub> footprint

## HOW AIR PRODUCTS HAS THE POWER TO HELP YOU.

Across many industries, our process and efficiency improvements have unlocked substantial potential savings – gains of more than 20% are not uncommon. Our industrial gases, technology and services are involved in, and can help optimise every stage of the battery production process.

### **Mining/Refining**

- Ore processing, recovery and smelting

### **Chem Processing**

- Carbonylation
- Inerting

### **Battery Component Manufacturing**

- Annealing (busbars, foils, strip)
- Brazing (battery pack)
- Calcination (cathode)
- Drying (separator)
- Extrusion (profiles, connectors)
- Inerting (anode)
- Sintering (metallic, magnetic components)
- Soldering (PCB)
- Washing, Mixing, Drying (pCAM)

### **Battery Assembly**

- Inerting
- Leak detection
- Welding

### **Recycling**

- Cryogenic liberation
- Fire suppression
- Hydrometallurgy
- Pyrometallurgy
- Shredding Inerting
- Solvent recovery



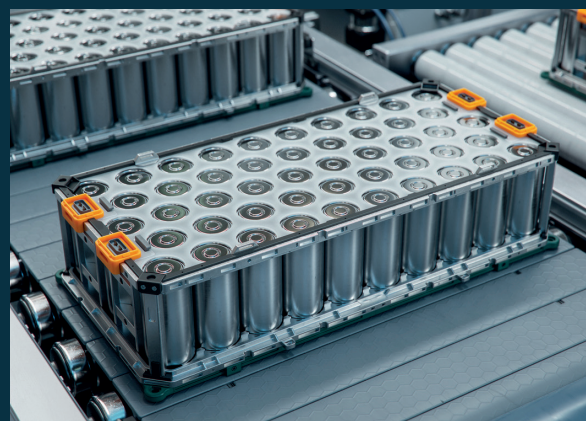
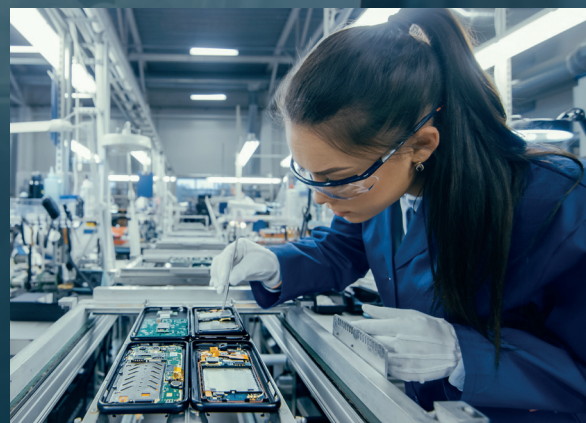


## THE POWER OF COMPREHENSIVE TECHNICAL SUPPORT.

We offer a wide range of support for lithium-ion battery production, from computational modelling and thermodynamic calculations to engineering consulting during project design, start-up and ongoing operations. We also have a dedicated team including R&D which can look after site services for your plant and process – all designed to help you improve process efficiency, optimise product quality, control risks and meet legislative requirements.

### **Our services include:**

- Atmosphere detection for product quality control, production safety and environmental protection
- Furnace atmosphere monitoring to examine the heat treatment process and improve product quality using Air Products Smart Technology
- Atmosphere recycle and reuse to save resources and reduce cost
- CFD flow field and thermal field simulation to effectively optimise parameters, reduce the number of experiments and improve optimisation efficiency



# GAS APPLICATIONS FOR THE BATTERY SUPPLY CHAIN.

## Battery Cell Assembly

### Nitrogen (N<sub>2</sub>)

Inerting during cell assembly/glove boxes, clean rooms, environmental stress chambers

### Helium

Leak testing

### Argon (Ar) / Carbon Dioxide (CO<sub>2</sub>)

Welding

### Carbon Dioxide (CO<sub>2</sub>)

Fire suppression systems

## Battery Recycling

### Nitrogen (N<sub>2</sub>)

Inerting during mechanical shredding and solvent recovery

### Oxygen (O<sub>2</sub>)

Pyrometallurgy

### Oxygen (O<sub>2</sub>) for ozone production

Hydrometallurgy (metal recovery)

### Carbon Dioxide (CO<sub>2</sub>)

Fire suppression systems in battery storage

## Anode Materials

### Nitrogen (N<sub>2</sub>) / Argon (Ar)

Graphite manufacturing and graphite-silicon manufacturing

## Electrode Foils

### Nitrogen (N<sub>2</sub>) / Hydrogen (H<sub>2</sub>)

Copper/aluminium electrode manufacturing

## Cathode Materials

### Oxygen (O<sub>2</sub>)

Nickel-based (i.e. NMC) cathode materials

### Nitrogen (N<sub>2</sub>)

Iron-based (i.e. LFP) cathode materials

## Separator / Electrolyte

### Nitrogen (N<sub>2</sub>)

Separators, electrolyte manufacturing (inerting/clean rooms)

For more information,  
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