energy storage enabling sustainable action

STEM* in the Harborough Community

**Science, Technology, Engineering & Maths*

Dr Robert Gibbison

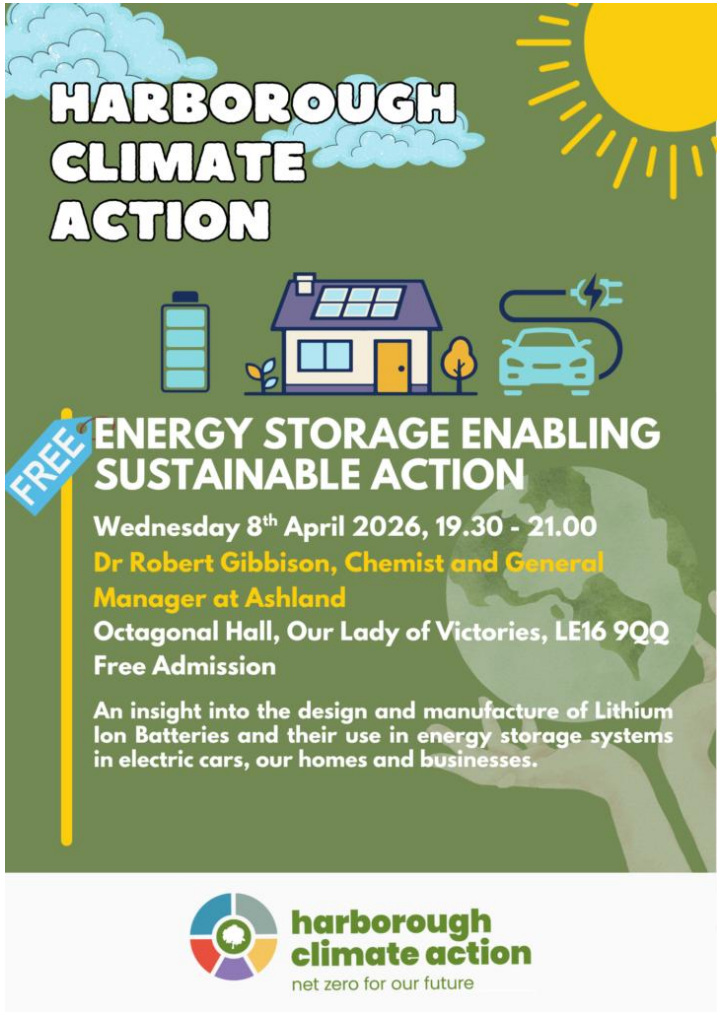
General Manager, Specialty Additives Europe

8 April 2026


Lithium-ion batteries

energy storage enabling sustainable action

- Who are Ashland?
- Who am I?!
- Why lithium-ion batteries are so important
  - How they work
  - Who developed them
  - How / where they are made
  - Different batteries and where they are used
- What technologies are coming next?
- Question and answer session



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Ashland at a glance (NYSE: ASH)

life sciences



35% of sales[1]

- pharmaceuticals
- nutrition
- crop care

personal care



32% of sales[1]

- skin care
- hair care
- oral care
- household

specialty additives



28% of sales[1]

- coatings
- performance specialties
- construction
- energy/resources

intermediates



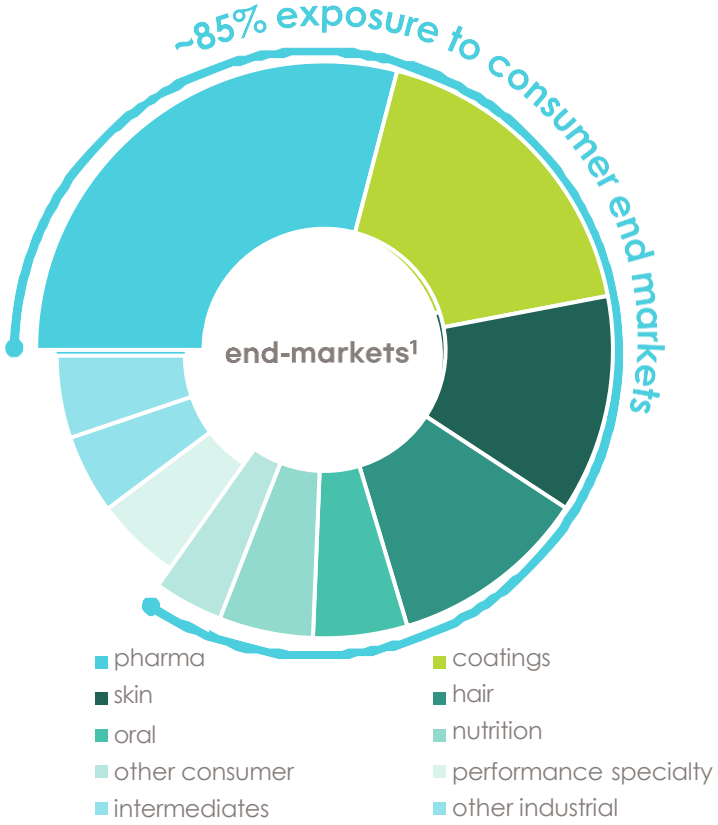
5% of sales[1]

- internal consumption
- semiconductors
- electric-vehicle

sales breakdown







$1.8 billion
sales[1]

$401 million
adj. EBITDA[1]

22.0%
adj. EBITDA margin[1]

$3.38
adj. EPS[1]

$127 million
ongoing FCF[1]

32%
ongoing FCF conversion[1]

[1] Note: all figures are presented on an adjusted basis except sales. Ashland's Annual Report for F2025 includes reconciliations of adjusted amounts reported under GAAP.

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driven by long-term secular industry trends

aging population



number of people aged 60+ will more than double by 2050

sustainability & social progress



improved access to education, health care, and economic opportunities

emerging technologies



increased adoption of biotechnology and AI

rising middle class



~2/3 of the world's population will be part of middle class by 2030

clean beauty



preferences for sustainable, cruelty-free, fair trade, and low-carbon products

global urbanization



~70% of world's population will live in urban areas by 2050

global megatrends shape our growth agenda

Ashland ingredients

STEM in the community

found in many products you use every day

life sciences
- medicine
- agriculture
- food and beverages

personal care
- skin and sun care
- hair care
- make-up
- toothpaste

specialty additives
- paints and coatings
- batteries
- construction

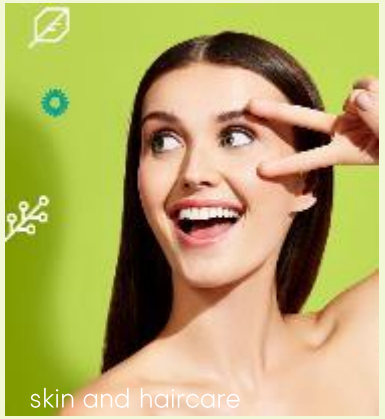


STEM is everywhere













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my STEM career path

6 years											
9 years											
11 years											
2.5 years											
2.5 years											
PhD (doctorate)											
BSc (degree)											
'A'-level											
'O'-level (GCSE)	English language	English literature	French	physics	chemistry	maths	biology	geography	religious education	graphic design	

26 years at Ashland

15 years with batteries

general manager

global strategic marketing director

lab manager/ marketing director

industrial team leader

hygiene chemist

chemistry

chemistry

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L'ORÉAL

Rentokil Initial

University of BRISTOL

University of BRISTOL

TRESHAM COLLEGE Part of The Bedford College Group

CIM The Chartered Institute of Marketing

+ diploma in professional marketing

STEM in the community



On holiday Morocco 2025:
L-R: Laura, Me, Paul & Françoise

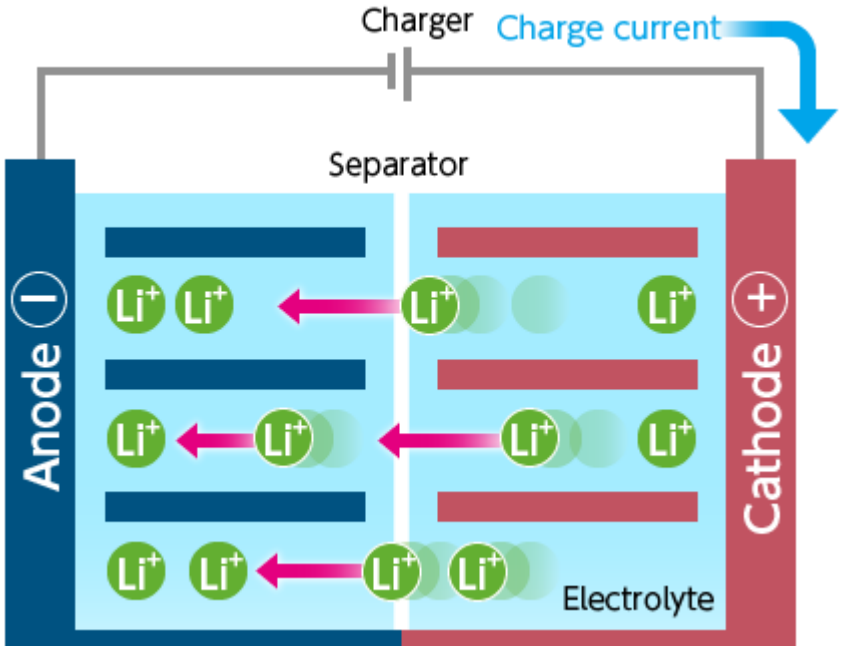


On holiday Brittany 2024:
Chloe

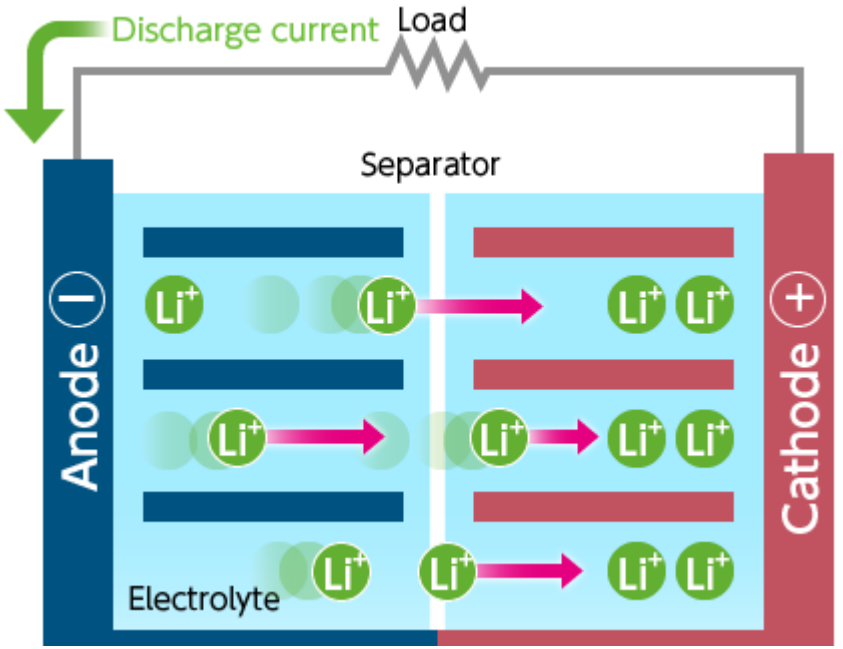
Bishop Stopford School

Lithium ions move in the rechargeable lithium-ion battery

During charging



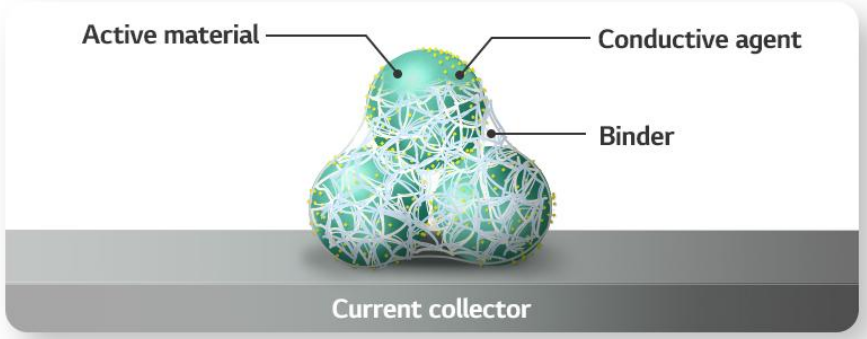
During use



chemical energy is converted to electrical energy

what's inside a lithium-ion battery

What's inside



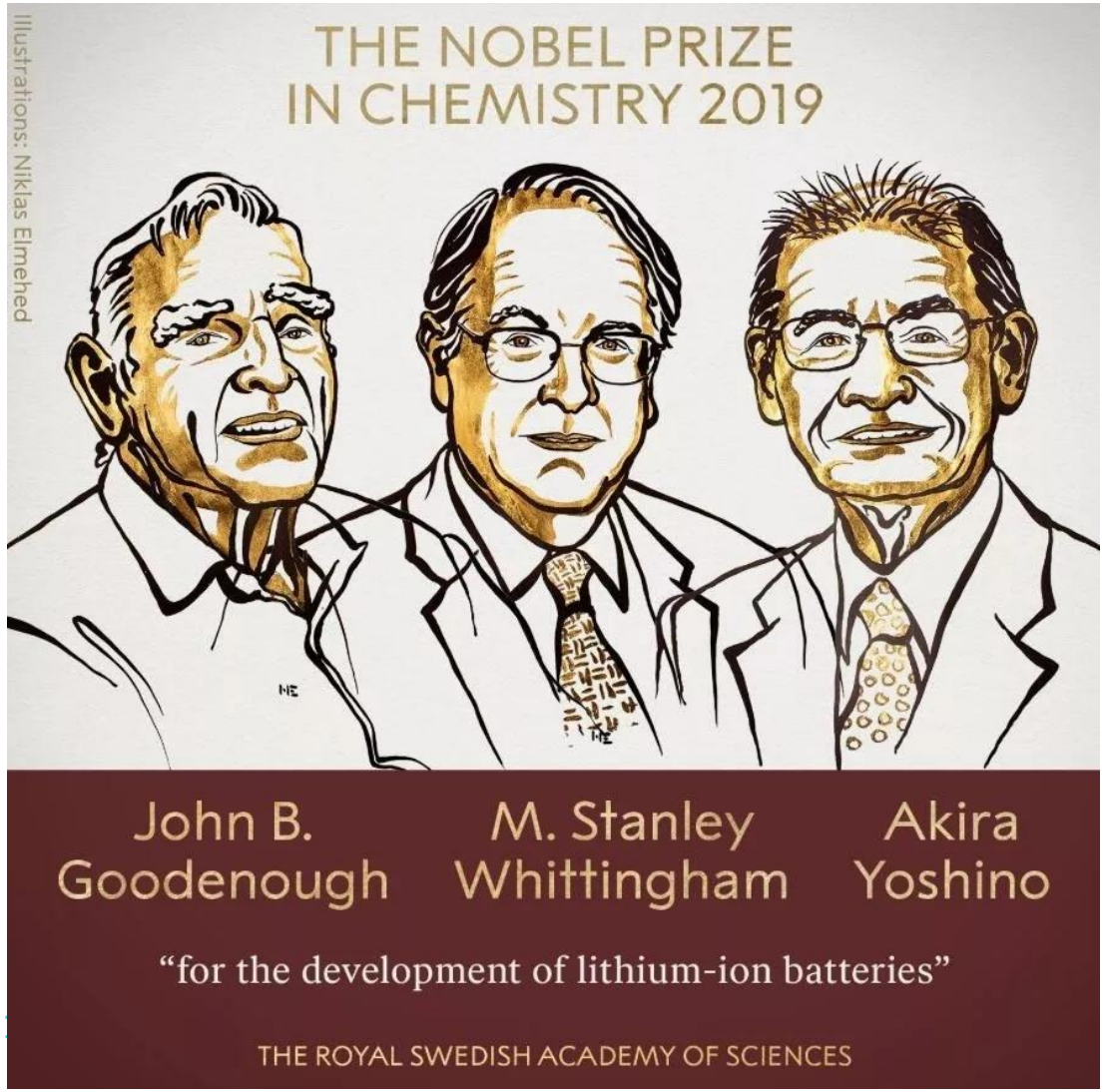
electrode	Cathode (+)	Anode (-)
Current collector	Aluminium	Copper
Active material	LFP	Graphite
Binder	PVDF	**CMC**/SBR
Conductive agent	CNT	CNT



LFP = lithium iron phosphate
PVDF = poly vinylidene fluoride
CNT = carbon nano tube
CMC = carboxy methyl cellulose
SBR = styrene butadiene rubber

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the brains behind the batteries we take for granted



- First invented early 1970s
- Voltage doubled in 1980
- Commercially viable anode 1985
- First commercial launch 1991 Sony

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where lithium-Ion batteries are made today



- Manufactured using a coating process
  - Water-based slurry coated onto copper for anode
  - Solvent-based solution coated to aluminium for cathode
- Fitted inside a 'cell' with electrolyte and separator
- For large volume eg for electric vehicles made in battery 'gigafactories'
  - Cells put into modules
  - Module put into packs
- Mostly in China but also S Korea
- Starting to operate gigafactories in Europe
  - Picture shown Verkor in Dunkirk, France

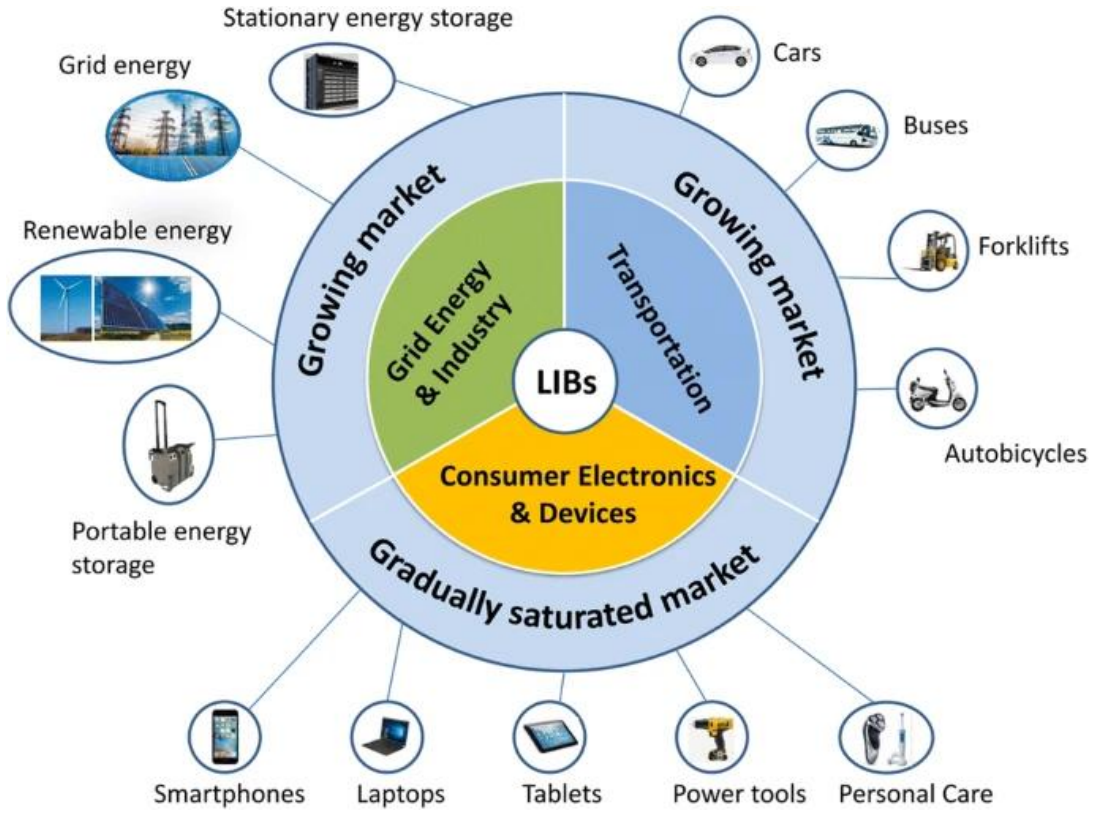
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Lithium-ion battery types and where they are used

- Must be:
  - ✓ Safe
  - ✓ Hold lots of energy
  - ✓ Be able to charge quickly
  - ✓ Be able to discharge quickly
  - ✓ Last a long time
  - ✓ Be cost-effective
- Different types of cells
  - may be used together in packs or modules



source: www.licarco.com



source: Yuanli Ding et el., Automotive Li-Ion Batteries: Current Status and Future Perspectives, Electrochemical Energy Reviews, 2019


consumer electronics


transportation


transportation


energy storage systems

what technologies are coming next?



- Battery advances:
  - PFAS-free*
  - Sodium-ion
  - Solid state
- Alternatives:
  - Hydrogen fuel cells
  - …

*per- and polyfluoroalkyl substances, sometimes known as 'forever chemicals'

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Ashland R&D center & technical lab to support batteries customers

Ashland headquarter in Wilmington, Delaware, USA



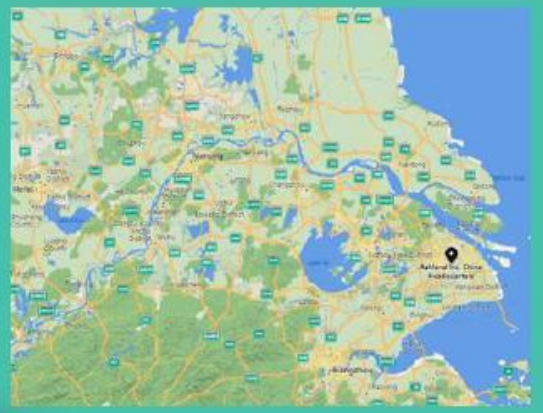


central R&D and batteries technical center





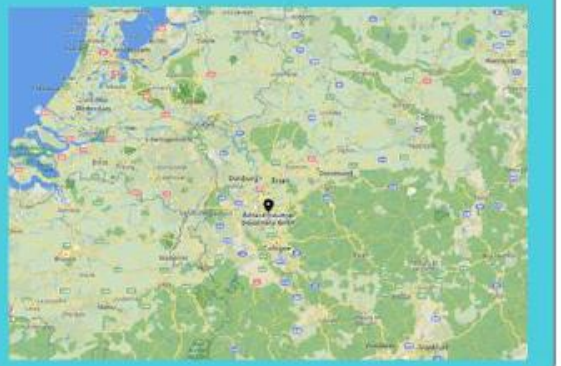
batteries lab at Shanghai, China





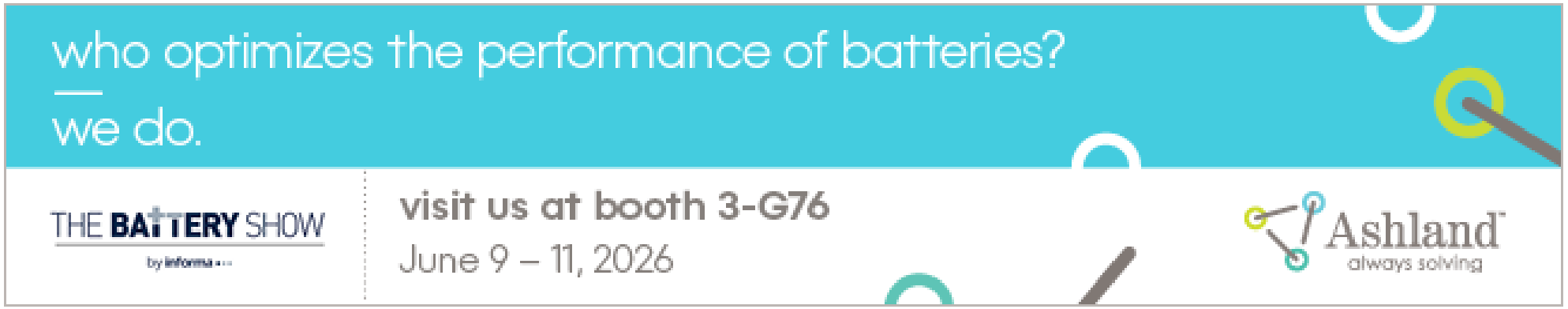
batteries lab at Düsseldorf, Germany





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want to learn more? Visit the battery show in Stuttgart!



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