

The HighMag Consortium

A collaborative effort of leading research institutions and industry partners:



universität freiburg



IMPERIAL



HighMag



High-energy, low-cost and scalable
generation 5 magnesium-based batteries
for mobility applications and beyond

HighMag: Building
a sustainable,
high-performance
future for energy
storage.



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the European Union

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Powering Tomorrow: Sustainable Magnesium Batteries

The global push for decarbonisation demands advanced energy solutions. While Lithium-ion batteries (LIBs) are common, their limitations – cost, raw materials, recyclability, and safety – highlight a critical need for alternatives. **HighMag is developing Rechargeable Magnesium Batteries (RMBs), a "Generation 5" technology offering a sustainable and superior solution.**

Why Magnesium?

HighMag focuses on magnesium for compelling advantages:

- ▶ **Abundant & Affordable:**
Far more plentiful than lithium, leading to lower environmental and economic costs.
- ▶ **High Energy Density:**
Superior volumetric capacity (3833 mAh/cm³) for more compact, energy-dense batteries.
- ▶ **Enhanced Safety:**
RMBs inherently offer improved safety.
- ▶ **Sustainability:**
HighMag integrates Safe and Sustainable by Design (SSbD) principles throughout.

HighMag's Innovative Approach

HighMag is tackling RMB development with two advanced cathode chemistries:

- ▶ **Magnesium-Sulphur (Mg-S) Batteries:**
High-capacity conversion cathodes using abundant, non-toxic sulphur.
- ▶ **Magnesium Metal Batteries (MMBs):**
High-voltage insertion cathodes leveraging multivalent Mg² for increased capacity, using inexpensive magnesium and abundant transition metals.

Both systems will utilise a novel powder-based anode with protective coatings.

Advancing to Real-World Application
HighMag's comprehensive strategy moves beyond materials:



Core Components

Developing sustainable, PFAS-free electrolytes and functionalised separators.



Performance

Integrating electrocatalysts and protective coatings for enhanced durability.



Understanding

Using operando characterisation for deep insights into material behaviour.



Manufacturability

Implementing aqueous-based electrode processing compatible with existing Li-ion infrastructure for easy scale-up.



Commercialisation

Developing business guidelines to support the EU battery industry

HighMag will advance Mg-based technology from TRL 2 to TRL 4, targeting a EUCAR level of 3 for mobility applications.