PROJECT

MagIC

Magnesium Ion Cell

Magnesium Ion Cell

Funding: National (Austria)

Duration: Jul 2013 - Jan 2017

Status: Complete

Objectives:

The rechargeable magnesium battery has the potential of replacing lithium ion batteries in the area of electromobility. In contrast to lithium, the electrochemical deposition and dissolution of magnesium is not plagued by dendrite formation. The high volumetric capacity of 3832 mAh/cm3 (lithium: 2062 mAh/cm3) in conjunction with an optimized electrolyte and a suitable cathode can thus be exploited to build a magnesium battery with an energy density of up to 500 Wh/kg (lithium: up to 300 Wh/kg). Such a battery would make electrically driven vehicles highly attractive. Due to its lower reactivity compared to lithium, magnesium offers higher safety in technical applications. It is much more abundant and also more environmentally benign than lithium. These advantages are accompanied by a number of obstacles, which will be overcome in the MagIC project.

The development of an electrolyte that permits the reversible electrochemical deposition and dissolution of magnesium at the anode is of central importance. At the same time the oxidative stability of the electrolyte has to be such that it allows the reversible insertion into and extraction of magnesium ions from the cathode material at potentials above 3 volts versus the magnesium electrode. Lead managed by the AIT, experts in each of these fields have joined forces in the MagIC consortium to develop the future battery technology. On the anode side, the Graz University of Technology collaborates on the optimization of the electrolyte with specialists of the Light Metals Competence Center Ranshofen GmbH, who develop a fabrication process for thin foils of magnesium as anode material. The reversible electrochemical deposition and dissolution of magnesium is not possible with conventional electrolytes used e.g. in lithium ion batteries. It is thus planned to use magnesium-organoborate electrolytes or mixtures of so-called ionic liquids. These electrolytes have to be further optimized in order to be compatible with novel cathode materials developed by a team in the AIT Mobility Department. An insertion/extraction process of the magnesium ions at potentials above 3 volts versus the magnesium electrode will render possible a hitherto unrivalled energy density in such cells.

Already at an early stage of development highly efficient simulation software will be used on the basis of experimental data by the company partner AVL List GmbH to support the partners in the area's device safety, cell management and battery design. The expert knowledge of a battery manufacturer will be available to the consortium through the company partner VARTA Micro Innovations GmbH for the fabrication of prototypes and their testing. The fabrication processes used for the components of the magnesium battery match those of the lithium ion battery. It is thus expected that there will be a smooth transition of the lithium ion to the magnesium battery fabrication technology.

Parent Programmes:

MOTF - Mobility of the Future

Institute type: Public institution

Institute name: FFG - Die Österreichische Forschungsförderungsgesellschaft

Funding type: Public (national/regional/local)

Other programmes: Mobilität der Zukunft - 1. Ausschreibung (2012)

Lead Organisation:

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Technologies:

Electric vehicle batteries (and energy management)
Magnesium battery concept for EVs

Development phase: Research/Invention

STRIA Roadmaps: Transport electrification, Vehicle design and manufacturing

Transport mode: Road transport

Transport sectors: Passenger transport, Freight transport

Transport policies: Environmental/Emissions aspects

Geo-spatial type: Other