YAGI LAB.

Let's think about it! The Science of Rechargeable Batteries

Research Center for Sustainable Material Energy Integration

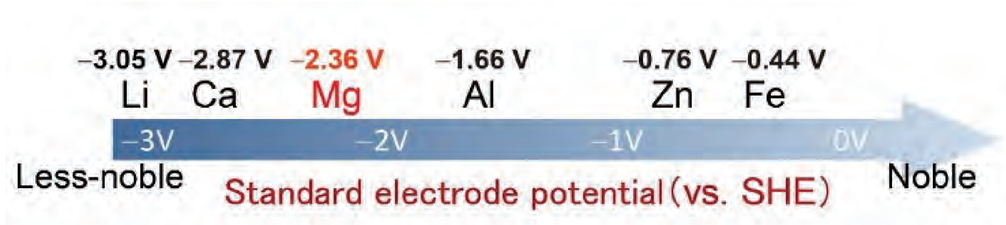
Energy Storage Materials Engineering
Department of Materials Engineering, School of Engineering
https://www.yagi.iis.u-tokyo.ac.jp/en

Innovative Rechargeable Batteries and Highly Efficient Electrochemical Processes

Yagi laboratory has developed rechargeable batteries based on novel ideas and highly-active electrochemical catalysts composed of abundant elements for the growth of the sustainable society.

Magnesium Rechargeable Battery

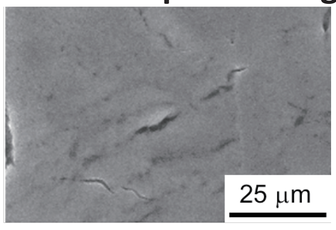
Magnesium has two valence electrons and the lowest standard electrode potential among the metals usable in air. The electrochemically deposited magnesium surface tends to be flat. We investigate magnesium battery technologies to achieve rechargeable batteries with high energy densities that permit easy handling.



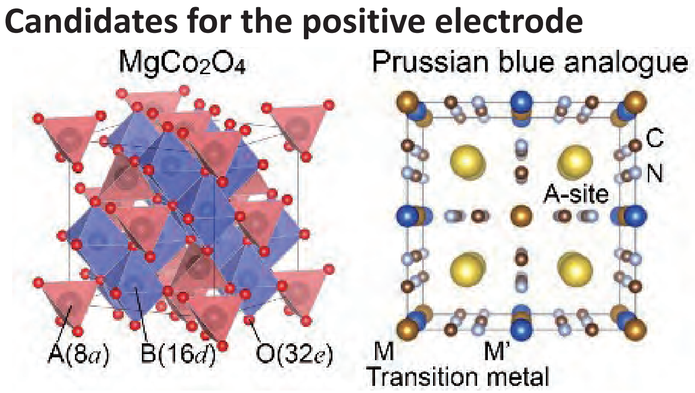
High capacity of Mg

	Potential (V vs. SHE)	Capacity (mAh/g)	Capacity (mAh/cc)
Mg	−2.36	2200	3830
LiC_6	−2.8	372	841
Li	−3.05	3860	2070

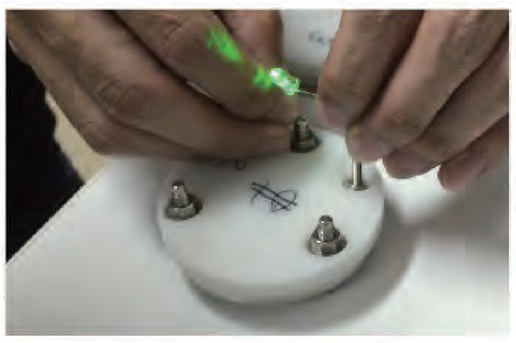
Flat surface of the electrodeposited Mg



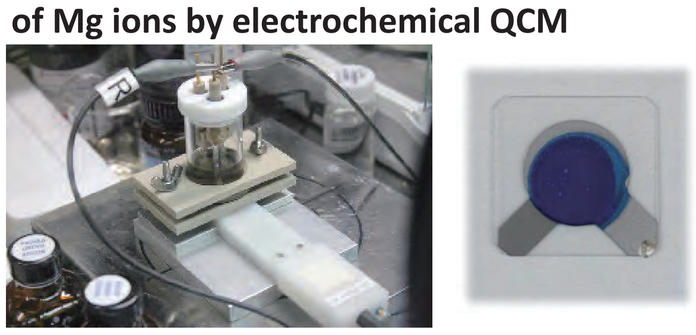
Candidates for the positive electrode



Prototype of the Mg battery



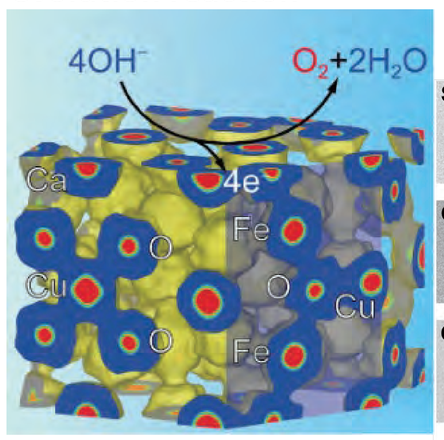
Analysis of the insertion/extraction behavior of Mg ions by electrochemical QCM

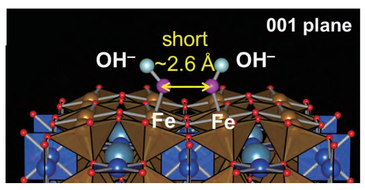


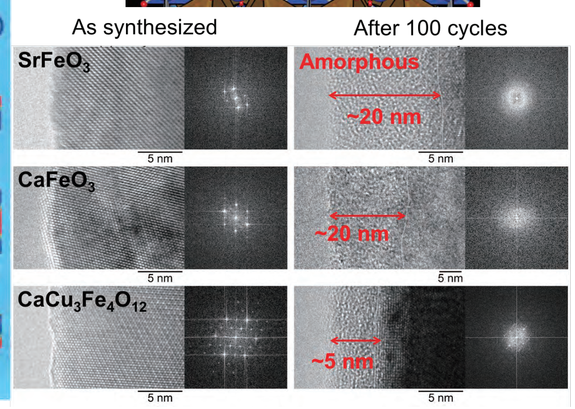
Catalysts for Electrochemical Reactions

Oxygen electrochemical reactions are highly important and are used in fuel cells and rechargeable metal-air batteries. Meanwhile, CO_2 electroreduction (CO_2RR) offers a sustainable approach to converting CO_2 into fuels and value-added chemicals. We investigate highly active catalysts to promote these electrochemical reactions.

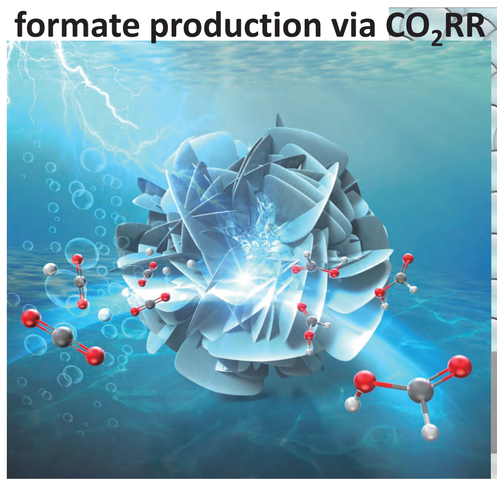
Highly active oxide catalyst $CaCu_3Fe_4O_{12}$ for the oxygen evolution reaction







Defect-driven bismuth nanoflower catalyst promoting formate production via CO_2RR



Reaction promotion mechanism at low-coordinated Bi sites