(ILM Joint Usage/Research)

Institute of Light Metals (ILM) Joint Usage/Research Grant Report in FY 2024

2025/05/15

Principal investigator	Affiliation	Charles University
	Job title	Assistant Professor
	Name	Daria Drozdenko
Collaborated researcher of ILM	Affiliation	Institute of Light Metals / Magnesium Research Center
	Job title	Director
	Name	Prof. Yoshihito Kawamura
Title of the joint research	Investigation of rapidly solidified ribbon-consolidated Mg-Zn-Y-based alloys with Ca, Mn, Nd microalloying	
Joint research Program ※check the box	☐ Program for Joint Usage / Research Centers (JURC) **X** Program for International JURC ☐ Program for providing samples and materials ☐ Program for using ILM facilities for sample analysis and characterization	☐ Focused themes ☐ Transportation **X** Biomaterials **X** Bridge/building materials ☐ Kink strengthening ☐ Independent research theme
Name of joint usage apparatus	Material preparation: melting furnace, rapid solidification machine, extruder; Sample preparation: lathe, cutting machines; Basic microstructure analysis (chemical composition and optical microscopy): ICP Emission Spectroscopy SHIMADZU ICPS-8100, Confocal microscope Lasertec OPTELICS HYBRID	
Total amount of grant	Travel expense (200 000 JPY)	Consumable Fee (50 000 JPY)

Research Results

【The major results】

The project was focused on the investigation of the effect of the microalloying by Nd, Mn, and Ca on the microstructure and properties of low-alloyed Mg-Zn-Y-based alloys prepared by the rapidly solidified ribbon-consolidation (RSRC) technique. The investigated alloys are characterized by ultrafine-grained (UFG) bimodal microstructure with small dynamically recrystallized (DRX) grains (about 500 nm) and elongated non-DRX grains with a size of few μm in transversal direction and up to 20 μm in the extrusion direction. The area fractions of DRX grains are about 90% in the case of MgZnYMn alloy and about 60% in MgZnYNd and MgZnYCa alloys. All investigated alloys are characterized by dispersedly distributed (in grain interior) Zn/Y-rich stacking faults formed in basal planes. Moreover, $Mg_{14}Nd_2Y$, cubic particles of pure Mn, and Mg_2Ca particles can be found in the microstructure of MgZnYNd, MgZnYMn, and MgZnYCa alloys, respectively. Developed microstructure resulted in high yield strength, reaching about 450 MPa and 375 MPa in tension and compression, respectively. The lowest yield point asymmetry is observed in MgZnYCa alloy. At the same time, this alloy shows the lowest corrosion rate (revealed by the linear polarization method and mass weight loss testing).

【Future Prospects】

The RSRC low-alloyed Mg-Zn-Y alloys are known for their exceptional thermal stability of the microstructure. Therefore, the thermal stability of Mg-1.5Y-0.56Zn (at.%) alloy with microalloying (up to 0.4at.%) of Ca, Mn, Nd elements (with a particular attention to MgZnYCa alloy) will be revealed for uncovering the potential of practical application of the developed material.

【Concrete results】

The obtained results are summarized in the manuscript “Effect of the micro-alloying by Nd, Mn, and Ca on the microstructure and properties of ultrafine-grained Mg-Zn-Y-based alloys” for publication in journal with an impact factor (e.g., Journal of Magnesium and Alloys, or Journal of Alloys and Compounds).

Notes

・Please use the form and submit to the URL provided in the email by Friday, May 16, 2025.
・The joint research report will be published in the ILM joint research report (annual report) and will be available on our website. Therefore, please prepare the contents for public release accordingly.
・Please add pages, if needed.