Institute of Light Metals (ILM) Joint Usage/Research Grant Report in FY 2022

2024/00/00

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| Principal investigator | | Affiliation | Norwegian University of Science and Technology | | |
| Job title | Professor | | |
| Name | Randi Holmestad | | |
| Collaborated researcher of ILM | | Affiliation | University of Toyama | | |
| Job title | Associate Professor | | |
| Name | Seungwon LEE | | |
| Title of the joint research | | Effect of homogenization treatment on age hardening behavior of Al-Mg-Si alloys | | | |
| Joint research Program  ※check the box | | □　Program for Joint Usage / Research Centers (JURC)  ☑　Program for International JURC  □　Program for providing samples and materials  □　Program for using ILM facilities for sample analysis and characterization | | | □ Focused themes  ☑ Transportation  □ Biomaterials  □ Bridge/building materials  □ Kink strengthening  □　Independent research theme |
| Name of joint usage apparatus | | Casting,　TEM | | | |
| Total amount of grant | Travel expense（　240,000　JPY） | | | Consumable Fee ( 60,000　JPY） | |
| **Research Results**　**※Please describe following three items briefly.**  【The major results】  Al-Mg-Si alloys are widely used as extrusion materials, and there is a demand for improved productivity, but as the extrusion speed increases, a defect called pick-up occurs, which limits the extrusion speed. It has been reported that this pick-up can be suppressed by homogenization, and research has been conducted on the structure and extrusion defects caused by homogenization conditions. In this study, we investigated the effect of homogenization on aging precipitation behavior by hardness tests and microstructural observations using optical microscopes and TEM.  -Optical microscope observation showed that the proportion of black areas caused by crystallized particles decreased with each step of homogenization → hot-extrusion → solution treatment.  - The hardness change curve showed a tendency for the decrease in hardness after peak hardness to be slower in the air-cooled material.  - The air-cooled material with an aging time of 2000 min had a low proportion of precipitates less than 40 nm in length, while without homogenization under the same aging conditions, many precipitates less than 40 nm in length were observed.  - Diffraction spots of the β' phase were observed in the selected area diffraction patterns of both the air-cooled material and the material without homogenization with an aging time of 2000 min.  【Future Prospects】  Although the aluminum industry has questioned the need for homogenization of 6000 series aluminum alloys and its effect on the final product, there have been few satisfactory systematic results. This study is a basic study on how the presence or absence of homogenization treatment affects the formation of precipitates in the final heat treatment by minimizing the influence of impurities by using a ternary alloy, additive elements other than Mg and Si, and high-purity materials. As a result of this study, no noticeable difference in mechanical properties was found depending on the presence or absence of homogenization treatment, but differences in precipitates were visible through electron microscope observation. Research into the causes of these subtle differences and the microstructural changes that occur during each heat treatment must continue.  【Concrete results】  Nothing in particular | | | | | |
| **Notes**  ・Please use the form and submit to ILM office (mrc@kumamoto-u.ac.jp) by Friday, April 28, 2023.  ・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. | | | | | |