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

2023/05/08

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| Principal investigator | Affiliation | Universiti Kebangsaan Malaysia, Malaysia |
| Job title | Assistant Professor |
| Name | Intan Fadhlina Mohamed |
| Collaborated researchers of ILM | Affiliation | MRC, Kumamoto University |
| Job title | Professors |
| Name | Zenji Horita |
| Title of the joint research | Developing high-strength Al alloys using processes of severe plastic deformation under high pressures |
| 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 | SEM, EBSD, Optical microscope, Hardness tester, Tensile testing machine  |
| Total amount of grant 300 000JPY | Travel expense（　300,000JPY） | Consumable Fee（ JPY） |
| **Research Results**　※Please describe the following three items briefly.【The major results】 This study used a process of severe plastic deformation (SPD) called incremental feeding high-pressure sliding (IF-HPS) where significant grain refinement is possible in an enlarged sheet area. The IF-HPS process was applied to Al alloys such as A1050, A3105, A5052 and A5182. The grain sizes were refined to the submiscrometer ranges and the tensile strength increased to almost twice as much as the annealed states. The conditions for the IF-HPS process were optimized so that the tensile strength remained high without initiation of cracks in the sheets. The crack initiation was less likely to occur as the sliding mode involved more numbers of reciprocations with shorter sliding distances. The process conditions were also investigated to achieve homogeneous development of the tensile properties throughout the processed sheets. It was shown that the IF-HPS process is useful to extend the SPD-processed area without increasing the machine capacity while maintaining enhanced mechanical properties. 【Future Prospects】 The application of the IF-HPS process was successful for the Al alloys. Thus, it is suggested that the application is made to Mg alloys such as AZ31, AZ61 and AZ91. To find an optimum conditions, the alloys are first processed by HPS. The grain refinement is evaluated in terms of the advent of superplasticity where the formation of fine grained structure is indispensable. 【Concrete results】<Publication>(1) T. Komatsu, T. Masuda, Y. Tang, I. F. Mohamed, M. Yumoto, Y. Takizawa and Z. Horita, Materials Transactions, Vol. 64, No. 2 (2023) 436-442. “Production of Ultrafine-Grained Aluminum Alloys in Upsized Sheets Using Process of Incremental Feeding High-Pressure Sliding (IF-HPS)”<International Conference>(1) T. Komatsu, T. Masuda, Y. Tang, I. F. Mohamed, M. Yumoto, Y. Takizawa and Z. Horita,The 18th International Conference on Aluminium Alloys (ICAA18) Toyama, Japan, Sept. 5-8, 2022.(2) T. Masuda, Y. Tanga, I. F. Mohamed and Z. HoritaKorea-Japan Joint Seminar Scientific research and technology application for Mg-based alloys and other light metals in South Korea and Japan, Kumamoto, Japan, October 5, 2022. |
| **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. |