

The Effect of Scandium on Thermal Stability and Fatigue Behavior of Ultra Fine Grained Al-Mg-Sc Alloy Produced by Severe Plastic Deformation

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2001 Fiscal Year Final Research Report Summary

The Effect of Scandium on Thermal Stability and Fatigue Behavior of Ultra Fine Grained Al-Mg-Sc Alloy Produced by Severe Plastic Deformation

Research Project

Project/Area Number

12650695

Research Category

Grant-in-Aid for Scientific Research (C)

Allocation Type

Single-year Grants

Section

一般

Research Field

Structural/Functional materials

Research Institution

KANAZAWA UNIVERSITY

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2000 – 2001

Keywords

ultra fine grain / Al-Mg alloy / Equal Channel Angular Pressing / scandium / zirconium / thermal stability / fatigue behavior

Research Abstract

The fatigue properties and thermal stability of fine grained Al-Mg-Sc-Zr alloy produced by equal-channel Angular Pressing (ECAP) are explored. The grain size are reduced to about 0.3 μm by ECAP processing. Comparing with ordinary Al-Mg alloy (5056 Aluminum alloy), in high cycle fatigue regime Al-Mg-Sc-Zr exhibits higher fatigue limit. On the other hand, low cycle fatigue life of Al-Mg-Sc-Zr alloy is shorter than that of 5056 aluminum alloy. Structural changes of these alloys during fatigue tests were investigated by transmission electron microscopy. It is shown that the fine structure of Al-Mg alloy achieved during processing is unstable and tend to relax with cycling, resulting in local recovery. In contrast there is no substantial microstructure changes in Al-Mg-Sc-Zr alloy after fatigue. Furthermore -result of microhardness

measurements after annealing reveals that structure of Al-Mg-Sc-Zr alloy is stable up to 773K. These observations prove that presence of Al₃(Sc, Zr) precipitates improves alloy quality in terms of both mechanical and thermal stability.

Research Products (12 results)

All Other
All Publications

[Publications] 出村良広: "ECAE法により作製した5056アルミニウム合金の高サイクル疲労特性"軽金属, 51. 324-328 (2001) ▼

[Publications] V.Patlán: "Overview of fatigue properties of fine grain 5056 Al-Mg alloy produced by equal-channel angular pressing"Materials Science and Engineering. A300. 171-182 (2001) ▼

[Publications] V.Patlán: "Cyclic response of fine grain 5056 Al-0Mg alloy produced by equal-channel angular pressing"Materials Science and Engineering. A319~321. 587-591 (2001) ▼

[Publications] K.Kitagawa: "On the Mechanical Behavior of Fine-grained 5056 Aluminum Alloy Produced by Equal-Channel Angular Pressing"Proceeding of PRICM4. 2595-2598 (2001) ▼

[Publications] 東 健一: "熱処理を施した超微結晶5056アルミニウム合金の引張及び低サイクル疲労特性"軽金属, 51. 646-650 (2001) ▼

[Publications] A.Washikita: "Tensile and Fatigue Properties of Al-Mg-Sc-Zr alloy Fine-Grained by Equal-Channel Angular Pressing"Proceeding of TMS Annual Meeting. 341-350 (2002) ▼

[Publications] Y. Demura: "High cycle fatigue propertie of 5056 aluminum alloy produced by Equal-Channel Angular Extrusion (in Japanese)"J. Japan Instiyute of Light Metals. 51. 324-328 (2001) ▼

[Publications] V. Patlán: "Overview of fatigue properties of fine grain 5056, Al-Mg alloy produced by equal-channel angular pressing"Materials Science and Engineering. A300. 171-182 (2001) ▼

[Publications] V. Patlán: "Cyclic response of fine grain 5056 Al-Mg alloy produced by equal-channel angular pressing"Materials Science and Engineering. A319-321. 587-591 (2001) ▼

[Publications] K. Kitagawa: "On the Mechanical Behaviour of Fine-grained 5056 Aluminum Alloy Produced by Equal-Channel Angular Pressing"Proceeding of PRICM4. 2595-2598 (2001) ▼

[Publications] K. Higashi: "Tensile and low-cycle fatigue properties of heat treated ultra-fine grain 5056 aluminum alloy (in Japanese)"J.Japan Instiyute of Light Metals. 51. 646-650 (2001) ▼

[Publications] A. Washikita: "Tensile and Fatigue Properties of Al-Mg-Sc-Zr Alloy Fine-Grained by Equal-Channel Angular Pressing"Proceeding of IMS Annual Meeting. 341-350 (2002) ▼

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