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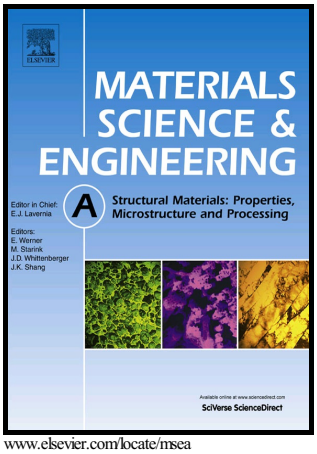

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Soft particles assisted grain refinement and strengthening of an Al-Bi-Zn alloy subjected to ECAP

Hailong Jia [a], Ruben Bjørge [b], Knut Marthinsen [a], Ragnvald H. Mathiesen [c], Yanjun Li [a,*]

[a] Department of Materials Science and Engineering, Norwegian University of Science and Technology (NTNU), 7491 Trondheim, Norway

[b] SINTEF Materials and Chemistry, 7465 Trondheim, Norway

[c] Department of Physics, Norwegian University of Science and Technology, 7491 Trondheim, Norway

[*]Corresponding author at: Department of Materials Science and Engineering, Norwegian University of Science and Technology (NTNU), 7491 Trondheim, Norway. E-mail address: yanjun.li@ntnu.no (Yanjun Li).

Abstract

With the aim to improve the strength of potential Pb-free Al-Bi based bearing alloys, an Al-6Bi-8Zn alloy was subjected to equal channel angular pressing (ECAP). To reveal the roles played by the soft Bi particles, an Al-8Zn alloy is compared. After five passes of ECAP (5P), ultrafine grained (UFG) microstructures are obtained in both alloys, while most of the Bi particles are deformed into the flake shapes. The yield strength (YS) of the as-deformed Al-6Bi-8Zn sample is more than three times as that of the as-cast sample. The influence of soft Bi particles on the deformation during ECAP and the final mechanical properties of the Al-6Bi-8Zn alloy are discussed. It is revealed that soft Bi particles have a strong influence on enhancing grain refinement during ECAP. At the same time, ECAP is found to accelerate the precipitation of the β(Zn) phase along grain boundaries (GBs).

Keywords: Aluminium alloy; ECAP; Soft particle; Precipitation; Tensile properties

1. Introduction

Aluminium-based hypermonotectic alloys (such as Al-Pb, Al-Bi and Al-In) are of particular interest as potential bearing materials due to the unique microstructures that form during solidification [1]. These alloys combine a volume fraction of soft secondary phase particles in a light weight α-Al matrix, resulting in a drastically low friction coefficient and very small wear resistance. Recently, the solidification of