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마찰 압연한 AA 1050 합금의 조직 변화

사이드무로드 아크라모프[1] · 김인수[1#]

Texture of Frictionally Rolled AA 1050 Aluminum alloy

S. Akramov[1], I. Kim[1#]

Abstract

A study on the texture and the formability after frictional rolled and subsequent heat-treated AA 1050 aluminum alloy sheets have been carried out. The specimens after the frictional rolling showed a very fine grain size, a decrease of <100> // ND, and an increase of <111> // ND textures. The change of plastic strain ratios has been investigated and it was found that they were higher than those of the initial Al sheet.

Key Words: Aluminum sheet, Shear Deformation, Texture, Cold rolling, Plastic strain ratio, Formability, r-value

1. Introduction

It is well-known that presence of preferred textures in Aluminum sheet can increase the formability properties. Most of studies have observed that the texture in recrystalized aluminum alloy sheets are consisting of remained texture by the rolling texture components {112}<111>, {123}<634> and {011}<112>. The {111} texture component parallel to the rolling plane may increase significantly formability properties of aluminum alloy sheet, but it is hardly appear in recrystallized aluminum alloy sheets [1–5].

In the present paper investigation the AA 1050 Al sheet was cold rolled without lubricant to investigate the effects of the severe shear deformation on texture and plastic strain ratio of subsequent heat treated AA 1050 Al sheet.

2. Experimental

Sheet of commercial AA1050 aluminum alloy was used to obtain a severe deformation by frictional rolling process. The sheet samples, with dimensions of 60mm x 40mm x 3mm, were prepared from a sheet along the rolling direction. Then these plates were annealed at 500°C for 1 hour to homogenize the initial grain size through thickness (named initial Al sheet). The annealed Al sheets were then frictionally rolled to different reductions ranging from 0 to 80% on a laboratory rolling mill. Hence we will observe only 80% cold rolled samples. To obtain high friction ratio no lubricant was used during rolling process. After the frictional rolling, to study the texture of the frictionally rolled Al sheets, samples were heat treated at the temperature of 275°C for 20 min in salt bath.

The texture change of the frictionally rolled and heat-treated samples, the incomplete pole figures of (111), (200), and (220) for each sample were measured by using X-ray goniometer. Texture measurements were performed at half thickness of the frictionally rolled sheets.

1. 금오공과대학교 신소재시스템공학부
교신저자: 금오공과대학교 신소재시스템공학부,
E-mail: iskim@kumoh.ac.kr

3. Experimental results and discussions

Fig.1 shows (111) pole figure cutouts of (1) one tenth thickness from the surface layer, (2) center layer of AA1050 aluminum alloy sheet: (a) initial Al sheet, (b) 85% frictionally rolled, (c) 85% frictionally rolled and subsequent heat treated at 275°C for 20 min.

Strong {001}<100> cube component is observed at center layer in initial Al sheet of Fig. 1 (1a). With frictionally cold rolling to the 85% reduction in thickness, {001}<100> cube component is disappeared in Fig. 1 (1b, and 2b), and the β-fiber component on the one tenth thickness surface layer are moved close to the normal direction about 5 degrees after the frictionally rolling without lubricant of AA 1050 aluminum alloy sheets in Fig. 1 (1b). The β fiber component on the center layer is a little moved close to the normal direction after the frictionally rolling without lubricant of AA 1050 aluminum alloy sheets in Fig. 1 (2b). This moving of β fiber component is obtained by the result of shear deformation during frictionally rolling process in Fig. 1 (2a, and 2b). The β fiber component on the one tenth thickness surface layer and center layer are not disappeared after frictionally rolled and subsequent heat treated at 270°C for 20 min in Fig.1 (1c, and 2c), respectively.

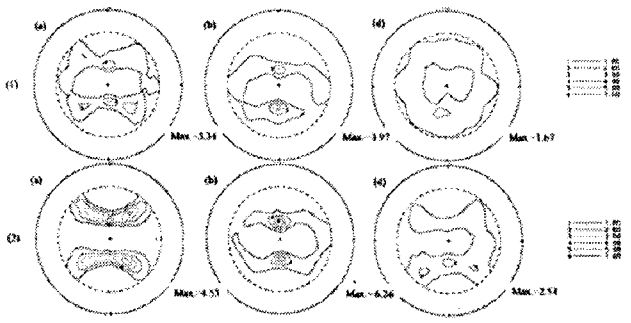

Fig.1 (111) pole figure cut outs from (1) one tenth thickness surface layer, (2) center layer of AA1050 aluminum alloy sheet: (a) initial Al sheet, (b) 85% frictionally rolled, (c) 85% frictionally rolled and subsequent heat treated at 275°C for 20 min.

4. Summary

The β fiber component on the one tenth thickness surface layer is moved close to the normal direction about 5 degrees after the frictionally rolling without lubricant of AA 1050 aluminum alloy sheets.

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