한국소성가공학회 2007년도 추계학술대회 논문집 pp. 326~327

# 비대칭 압연한 AA 1050 합금의 조직 변화

사이드무로드 아크라모프[1] · 김인수[1#]

# Texture of Asymmetrically Rolled AA 1050 Aluminum alloy

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

**Abstract**

A study on the texture and the formability after asymmetric rolled and subsequent heat-treated AA 1050 aluminum alloy sheets have been carried out. The specimens after the asymmetric 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, Rolling

## 1. Introduction

Many researchers are interested in optimization of the shear deformed metals and alloys. Using shear deformation processes can be obtained very fine grained materials with high strength but limited formability properties. In order to improve drawability and the lower planar anisotropy of AA 1050 Aluminum Alloy sheets, asymmetric rolling process were investigated in this study.

It has been found that the deformation in metals sheets of <111> plane parallel to the sheet surface helps to increase the r-value and variation of the textures decreasing $\Delta$r-values. However, due to the high energy stored in the deformed state and the existence of structural heterogeneities, annealing conditions are critical and unwanted structures may form. [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.

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

## 2. Experimental

Sheet of commercial AA1050 aluminum alloy was used to obtain a severe deformation by asymmetric 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 asymmetrically rolled to different reductions ranging from 0 to 85% on a laboratory asymmetrical rolling mill with roll ratio1.5. Hence we will observe only 85% cold rolled samples. To obtain high friction ratio no lubricant was used during rolling process. After the asymmetrical rolling, to study the formability of the asymmetrical rolled Al sheets, samples were heat treated at the temperature of 275°C for 20 min in salt bath.

The texture change of the asymmetrically rolled and heat-treated samples, the incomplete pole figures of (111), (200), and (220) for each sample were measured by using X-ray goniometer [7]. Texture measurements were performed at half thickness of the asymmetrically rolled sheets.

## 3. Experimental results and discussions

Fig.1 shows (111) pole figure cutouts of center layer of AA 1050 aluminum alloy sheet: (a) initial Al sheet, (b) 85% asymmetrically rolled, (c) 85% asymmetrically rolled and subsequent heat treated at 275°C for 20 min.

{001}<100> cube component is observed at center layer in initial Al sheet of Fig. 1 (a). After asymmetric cold rolling to the 85% reduction in thickness, {001}<100> cube component is disappeared in Fig. 1 (b), and the <111> // ND textures on the center layer are appeared after the asymmetric rolling without lubricant of AA 1050 aluminum alloy sheets in Fig. 1 (1b). The <111> // ND textures on the center layer are not disappeared after asymmetric rolled and subsequent heat treated at 270°C for 20 min in Fig.1 (c).

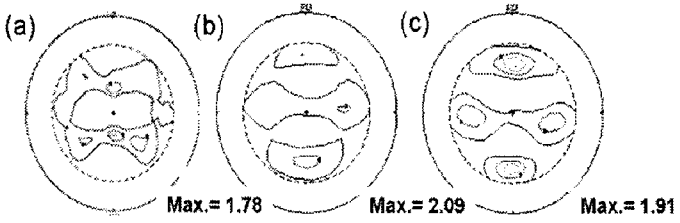


**Fig.1 (111), pole figure cut outs from center layer of AA 1050 aluminum alloy sheet: (a) initial Al sheet, (b) 85% asymmetrically rolled, (c) 85% asymmetrically rolled and subsequent heat treated at 275°C for 20 min.**

## 4. Summary

The <111> // ND texture components on the center layer is moved close to the normal direction after the asymmetrically rolling without lubricant of AA 1050 aluminum alloy sheets and remained after subsequent heat treatment at 275°C during 20 min.

## Acknowledgement

This paper was supported by the research fond of Korea Research Foundation Grant Funded by the Korean Government (MOEHRD) (KRF-2005-D00372).

## References

1. [1] PH. Lequeu and J. J. Jonas: Metal. Trans. A, Vol. 19A (1988), p. 105
2. [2] H.-D. Kim, M.-Y Huh, N.-J. Park, and Y.H. Chung, Met. Mater. Int. Vol. 9 (2003), P. 413
3. [3] Y. Saito, H. Utsunomiya, H. Suzuki and T. Sakai, Scripta Mater. Vol. 42 (2000), p. 1139
4. [4] S. Akramov, M.G. Lee, I. Kim, D.Y. Sung, B.H. Park, and I. Kim, Mater. Sci. Forum Vol. 495-497 (2005), p. 803
5. [5] K.J. Kim, H.-T. Jeong, K.S. Shin, and C.-W. Kim, J. Mater. Process. Tech. (2007), in press
6. [6] M. Hatherly, and W.B. Hutchinson: An Introduction to Textures in Metals, (Institution of Metallurgists, London, 1979)
7. [7] H.J. Bunge: Texture Analysis in Materials Science Mathematical Methods, translated by P.R. Morris (Butterworths, London, 1982)