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Abstract

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Uranium was plastically deformed 90% at room temperature by uni-directional rolling to a foil 0.002-inches thick. Specimens were recrystallized in the alpha region and several pole figures obtained from 0 to 40°. From these, the preferred orientation was found to be a spread of an idealized (100) [010] about [010].

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Recrystallized Texture of Alpha Uranium

W. Seymour and J. Duffey

General Electric Company
Knolls Atomic Power Laboratory*
Schenectady, New York

Introduction

The recrystallized texture of severely deformed uranium was determined in an effort to relate its origin to the deformation texture $(102) [010] + (012) [021]$, which has been reported.¹

Procedure

Alpha uranium was reduced 90% at room temperature by unidirectional rolling to 0.002" in thickness. Individual specimens were then heat treated for times varying from 30 seconds to one hour at 600°C. These specimens were all quenched from the annealing temperature. Microscopic examination showed that recrystallization apparently was complete within five minutes, and that little or no grain growth occurred within thirty minutes. As a consequence of these preliminary studies, a one-inch round section of the sheet was heated for ten minutes at 600°C and used for the texture determination.

An automatic reflection specimen holder² was used in conjunction with a G.E. XRD-3 Spectro-Goniometer to obtain charts of X-ray intensity versus specimen position for the (010), (100), (110), (021), (001), (111), (131), and (121) crystallographic planes. The specimen position varied in both rotation and inclination according to a stereographic spiral path described previously.¹

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The inclination range for each chart was 0 to 40° . No attempt was made to obtain data beyond this inclination since the first 40° proved sufficient for the texture determination.

Results and Observations

Charts for (200), (002) and (110) X-ray intensities versus specimen position for the recrystallized uranium sheet are shown in Figs. 1132626, 1132624 and 1132623. These charts, as well as charts for (010), (021), (111), (131) and (121) planes were plotted in stereographic projection (pole figures), some of which are shown in Figs. 1132617, 1132622, 1132621 and 1132620. From these data the idealized recrystallization texture can be described as a (100) $[010]$ orientation. *Fig. 1132619*

Discussion

The idealized recrystallization texture (100) $[010]$ can be derived from the cold rolled orientations by a simple 45° rotation about $[010]$ of the principal (102) $[010]$ component of the deformation texture, and a 20° rotation about $[100]$ of the second component of the deformation texture.¹ Both rotations are such that the maximum population of (100) planes occur parallel to the rolling surface.

The black dots on each of the pole figures locate the pole positions for the idealized recrystallization texture.

Little similarity could be found between the recrystallized texture of alpha uranium sheet and the recrystallized textures of the hexagonal close-packed metals,^{3,4,5,6,7} although a strong similarity had been observed between the deformation textures in a previous study.¹ The recrystallized texture of

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alpha uranium, does however, bear some resemblance to the "cubic texture" found in recrystallized copper, iron-nickel alloys and aluminum.

Some evidence for a relatively weak secondary component in the recrystallized uranium texture is observed in Fig. LL32621, and is indicated by circles approximately 20° from the center along the rolling direction. This was not pursued, but might be a remnant of the second component of the deformation texture.

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(111)
ROLLING PLANE
.002" URANIUM FOIL - RECRYSTALLIZED 600°C-5 MIN.

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ROLLING PLANE

002° URANIUM FOIL NO.11 RECRYSTALLIZED
600°C-5 MIN.

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(001)

ROLLING PLANE

002" URANIUM FOIL — RECRYSTALLIZED 600°C-5 MIN.

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(110)

ROLLING PLANE
.002" URANIUM FOIL NO. 11 RECRYSTALLIZED
600°C — 5 MIN.

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