Materials Science Forum Vols. 56 - 58 (1990) pp. 317-322

STUDY OF RUBBER-LIKE BEHAVIOUR IN A Au-47.5at%Cd ALLOY BY SYNCHROTRON-ORBITAL RADIATION

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ABSTRACT

The rubber-like behavior in a Au-47.5at%Cd alloy, which appears in a stabilized (aged) state of the martensite, remains an unsolved problem. As one possible mechanism of the behavior, Lieberman et al. proposed a model, in which twinning shear and shuffling are physically separated. They assumed that the former occurs instantaneously but the latter occurs with aging. To test the model, we carried out an X-ray diffraction experiment by a four-circle diffractometer using synchrotron orbital radiation with high intensity, since the aging time required for the behavior is short. Peak positions and integrated intensities were measured as a function of aging time, but no change was observed during aging. Thus, the Lieberman's model was denied.

1. INTRODUCTION

The "rubber-like" behavior in a Au-47.5at%Cd alloy has been so well-known eversince it was found by Ölander[1] in 1932, but the origin remains unsolved until now. It is a phenomenon which occurs in the γ_2' martensitic state without accompanying the reverse transformation to the parent phase. That is, the martensite is plastic immediately after the transformation from the β_2 parent phase, but it becomes rubber-like (i.e. twinning pseudoelastic) if it is aged (stabilized) at room temperature for 14 × 3.6 ks or so. The rubber-like behavior is known to occur by reversible movements of $\{111\}\gamma_2'$ twin boundaries upon loading and unloading[2]. However, the origin for the reversible movements of twin boundaries is not known yet. Although several mechanisms or models have been proposed, there are some shortcomings and no direct evidence has been presented for the models yet[3]. Birnbaum and Read[2] ascribed the origin to the interaction between twinning dislocation and order-faults inherited from the parent phase. Lieberman et al. [4] separated physically twinning shear and shuffling in the twinning process, and assumed that the former occurs instantaneously but the latter occurs with time during aging. Thus they could explain the rubber-like behavior. More recently, Sakamoto and Shimizu[5] considered that the aging (stabilazation) effect is