

Initiation of Slip Line Under Tensile Stress on Pure Copper

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ABSTRACT

A copper alloy occurs a slip line, when it receives a deformation of tensile. So as to accompany a micro phenomenon for a slip line, it is difficult to observe 3 dimensional measurement. For Atomic Force Microscopic (AFM), however, it is possible to observe on very micro shape. In this research, it is considered initiation phenomenon of the slip line that is a closely relevant to a fracture for ductility materials. A fracture begins with corroding new surface that occurs by slip in copper alloys. Several test specimens gave a tensile uni-axis loading with various stationary speeds. At that time, several test specimens with various strains were examined surface roughness measurement and were observed by an atomic force microscope. An occurrence frequency of the slip line are investigated from the results.

KEY WORDS: Shape Measurement, Fractal, Atomic force microscope, Pure copper, Slip line, Tensile stress

INTRODUCTION

Generally, it is said that pure copper is excellent about the ductility. Moreover, it is one of materials with high utility value as an industrial material. When slips were accompanied to pressure, the copper improved malleability and ductility. However, when the new phase according to a slip are corroded the occurrence of the crack might be caused even if it is excellent copper in an environmental strength[1]. In the process concerning a ductility destruction of the metal, the examination concerning the generation of the slip line which is the first change on the surface of metal is indispensable to elucidate valuable information about the destruction mechanism or the destruction cause. The shape of cross section and the size about the slip line generated by tensile test are clarified by the observation of the scanning electron microscope (SEM) which uses the replica method[2]. In the viewpoint of the formation mechanism of the slip lines and the generation frequency concerning the shape of the slip lines, the generation behavior of the slip line is hardly researched.

In this research, a tensile uni-axis loading was given to the annealed pure copper in atmosphere, and the load was pulled respectively till a fixed amount of strain. The surface of pure copper was observed with Atomic force microscope (AFM), and the generation frequency of slip lines was examined. Moreover, we paid attention to the displacement of horizontal direction and the vertical direction about slip lines, and examined the generation behavior of slip lines which related deeply to the fracture of a ductility material.

EXPERIMENT METHOD

Material and test specimen

The material used the rolling copper plate of 99.99% Cu. After the test specimen shape was cut out by the wire spark cutter machine, the test specimen was polished in order of the emery paper polishing and buffing. Afterwards, the test specimen was annealed in the vacuum of 773K×1hr. Electrolytic polishing was done in 70% phosphorus acid solution, and the surface of the test specimen was polished like mirror finished surface.

Tensile test

The tensile testing speed was set at 0.05 mm/min by the computer control system shimadzu autograph, and tensile test was done in the room

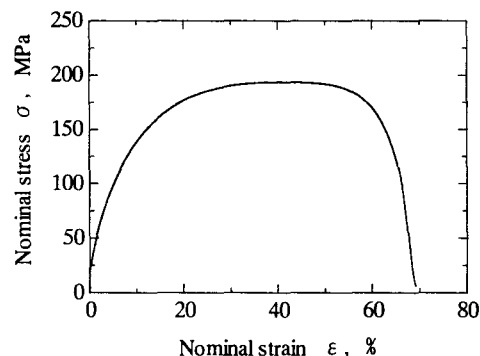


Fig.1 Stress-strain diagram of pure copper.