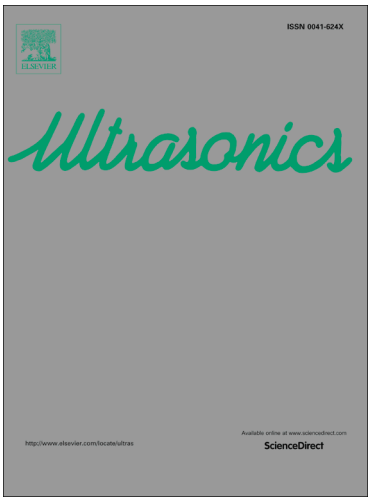

Effects of ultrasonic vibration on the compression of pure titanium

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Effects of ultrasonic vibration on the compression of pure titanium

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Abstract: The technology of ultrasonic vibration assisted plastic forming possesses a great many merits, such as reducing the deformation resistance and friction, as well as improving the surface quality of parts. In this study, the ultrasonic vibration assisted compression tests were carried out on pure titanium in order to improve its formability. The results indicating that the ultrasonic vibration had no effort on elastic deformation, and the temperature of material only increased by 6 °C after compression with applying the ultrasonic vibration. Therefore the influence of temperature increase on reduction of flow stress could be ignored. After excluding interface friction and temperature effects, ultrasonic vibration can still decline the flow stress, the mechanism of deformation includes ultrasonic softening, stress superposition and strain hardening. In the intermittent vibration tests, the material shows the residual softening effect after stopping vibration. By observing the microstructure of material with SEM, it shows that the ultrasonic vibration can promote the generation of deformation twins, causing the grain refinement and the reduction of the twins, which is the major factor of affecting the residual softening effect.

Keywords: Ultrasonic vibration; Softening; Pure titanium; Compression; Deformation mechanism.

1. Introduction

In recent years, Titanium and its alloys are widely used in aviation, spaceflight, electronics, transportation, medical, ocean engineering and other fields [1], because of its low density, high strength, good corrosion resistance, high temperature resistance and low temperature resistance, etc.[2] However, the plastic forming ability of