The Effect Of Ultrasound On The Irrecoverable Deformation Of Metals

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INTRODUCTION

In recent years, the advantages of using **ultrasonic vibration during plastic deformation** processes have been mostly studied experimentally. for instance, ultrasonic–

INTRODUCTION

In addition, there have been a few attempts on computational studies of ultrasonic-assisted metal forming (UAMF) processes. The most important issues for accurate investigation

INTRODUCTION

Many researches have attempted to explore a realistic mechanism caused to change mechanical behavior whenever the ultrasonic vibration is imposed on metal, but its accurate underlying mechanism was **still not so clear.**

A summary of literature review on reported acoustoplasticity mechanisms

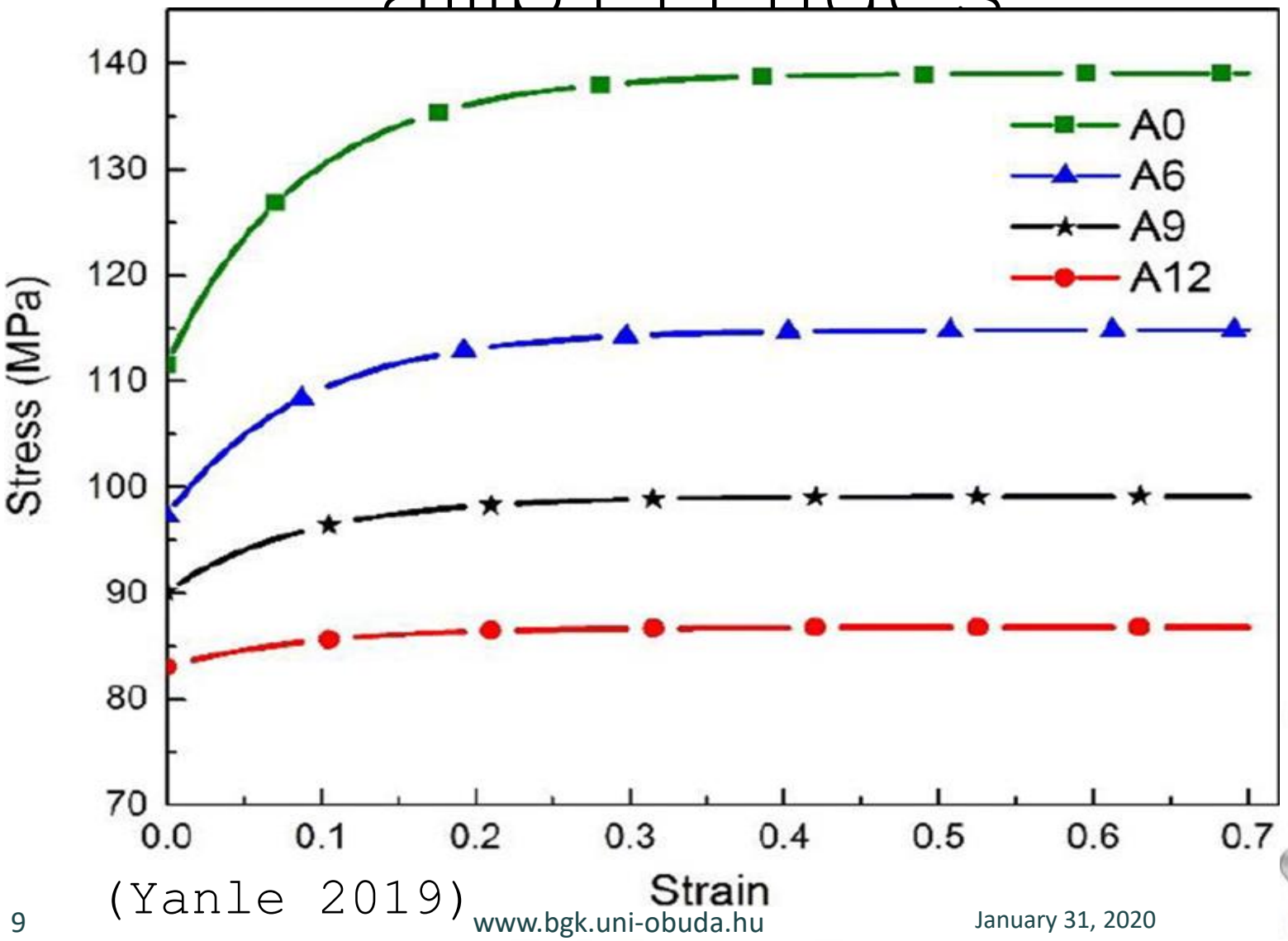
No.	Authors and year	Method of research	Reported mechanism
1	Langenecker 1966 (Ref 4)	Experiment	Absorption at dislocation sites and local heating
2	Izumi et al. 1966 (Ref 6)	Experiment and theory	Dynamic stress and heat generation
3	Baker and Carpenter,1967 (Ref 2)	Experiment	Mobility of dislocations by thermal activation
4	Kirchner et al. 1984 (Ref 3)	Experiment and theory	Superposition stress
5	Ohgaku and Takeuchi 1987 (Ref 7)	Experiment	Superposition stress and thermal effect
6	Malygin 2000 (Ref 5)	Theory	Oscillatory stress and dislocation motion
7	Daud et al. 2007 (Ref 19)	FEM and experiment	Superposition stress and energy absorption by microstructure
8	Liu et al. 2013 (Ref 10)	FEM and experiment	Superposition stress and dislocation movement and thermal effect

Bagherzadeh 2015

The first efforts to investigate the volume effects have been reported by Blaha and Langenecker in 1955. They observed **yield stress drop** in tension tests experimentally (called Blaha effect). Langenecker presented a basic equation based on material

The **acoustic softening** is considered to be more efficient than plasticity originating from the thermal softening. Even though the acoustic softening has been observed and studied for decades, **the**

The stress-strain curve with different amplitudes

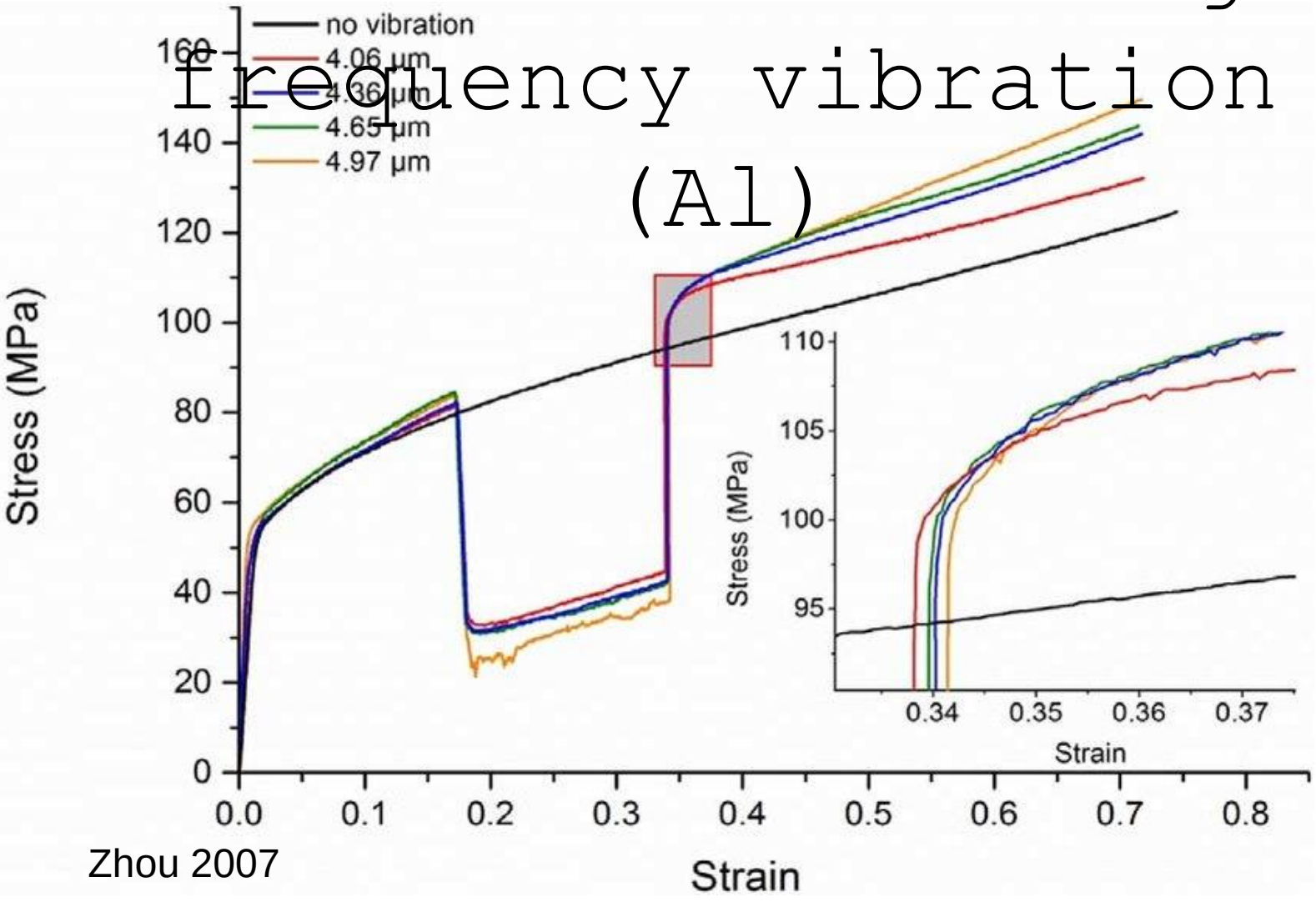


(Yanle 2019)

Besides the acoustic softening effect during the high-frequency vibration mentioned above, a **residual hardening** effect was detected in various studies. Unlike the acoustic softening, which only exists temporarily while the vibration is applied, the residual hardening effect is retained

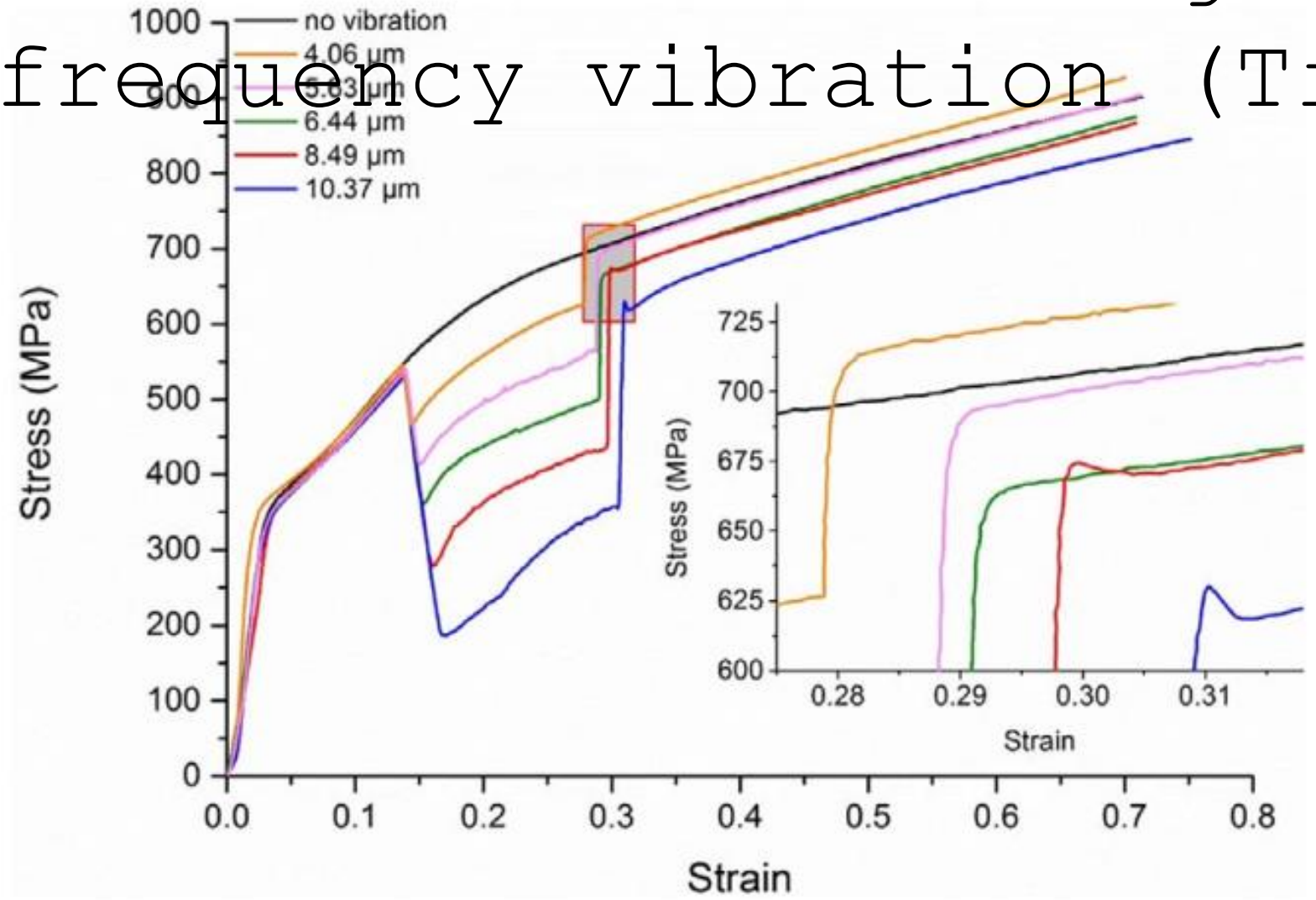
The residual effect caused by ultrasonic vibration is quite contrary between some metals (such as aluminium and titanium): residual hardening for

Stress–strain curves with and without high-frequency vibration (Al)



Zhou 2007

Stress–strain curves with and without high-frequency vibration (Ti)



Contents lists available at ScienceDirect

Ultrasonics

journal homepage: www.elsevier.com/locate/ultras

Analytical description of ultrasonic hardening and softening

A. Rusinko *

Rusinko (2011) developed an analytical model which introduced a new term, ultrasonic defect intensity, into the synthetic theory of plastic deformation. This model may describe the ultrasonic

Plans For Future Work

The plan is to develop a model accounting for the phenomenon of acoustic plasticity such as residual hardening. The model is planned to be developed in terms of the synthetic theory

Courses Completed

Code	Course	Lecturer	Number of credits
OATATVEM1ND	Finite element modeling of material technologies	Dr. Gonda Viktor	6
OAIAFRT1ND	Modeling of thermally activated transformation processes in alloys	Dr. Réti Tamás	6

Thank You

Any Question?