«Dökme A201 Alaşımının Mekanik Özellikleri Üzerine Mekanik Titreşim ve T6 Isıl İşleminin Etkisi»

«Effect of Mechanical Vibration and T6 Heat Treatment on Mechanical Properties of Cast A201 Alloy»

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3.Oturum / 3th Session

Oturum Başkanı / Session Chairman: Doç. Dr. Çağlar YÜKSEL (Marmara Üniversitesi)

Overview

- Introduction
- Objective
- Experimental Procedure
- Results of Study
- Conclusion
- Recommendations
- Questions

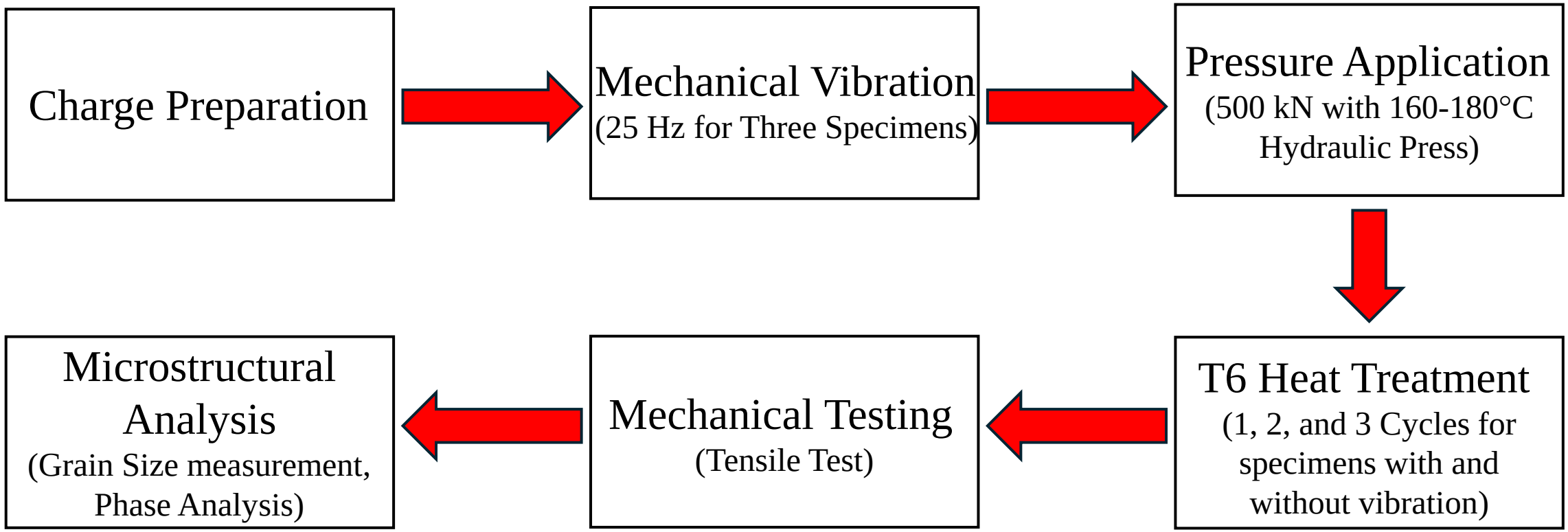
Introduction

- A201 Aluminum Alloy
  - Copper-based alloy
  - High-performance requirements
  - Various problems
    - Tensile strength and fatigue life
  - Structural defects
    - Pores and oxide biflims

Objective

- The aim of this study:
  - Observing the effect of mechanical vibration during solidification and T6 heat treatment after the squeeze casting process on the refinement of microstructure and increasing mechanical properties of A201 alloy.
  - Eliminating secondary dendrite arms and maintaining cellular solidification in the alloy structure.

Experimental Procedure



Experimental Procedure

- Charge Preparation

Elements	Al%	Cu%	Ag%	Mn%	Mg%	Fe%	Si%
Average	90.53	6.59	1.04	0.581	0.565	0.102	0.020

  - Cu% is higher than literature value (4.0 to 5.0 wt%) to increase copper rich ppt

Experimental Procedure

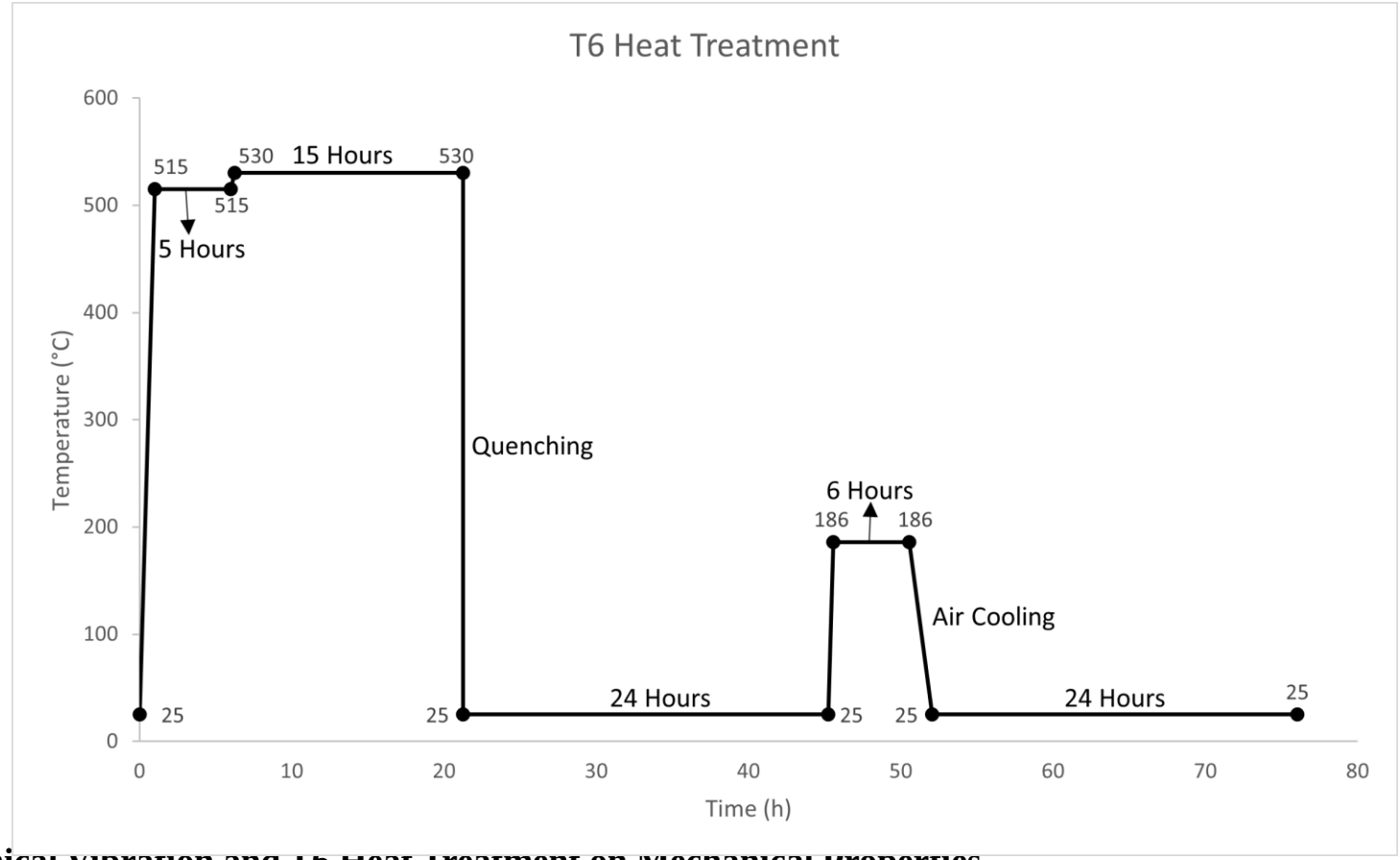
- Mechanical Vibration (25 Hz)
  - The first three specimens solidified with vibration
  - The last three specimens solidified without vibration

- Pressure Application during Solidification
  - 500 kN pressure with heated to 160-180°C hydraulic press

- T6 Heat Treatment
  - 1 cycle of T6 for Specimen 1(with vibration) and 4(without vibration)
  - 2 cycles of T6 for Specimen 2(with vibration) and 5(without vibration)
  - 3 cycles of T6 for Specimen 3(with vibration) and 6(without vibration)

Experimental Procedure

- T6 Heat Treatment (Temperature and Time)



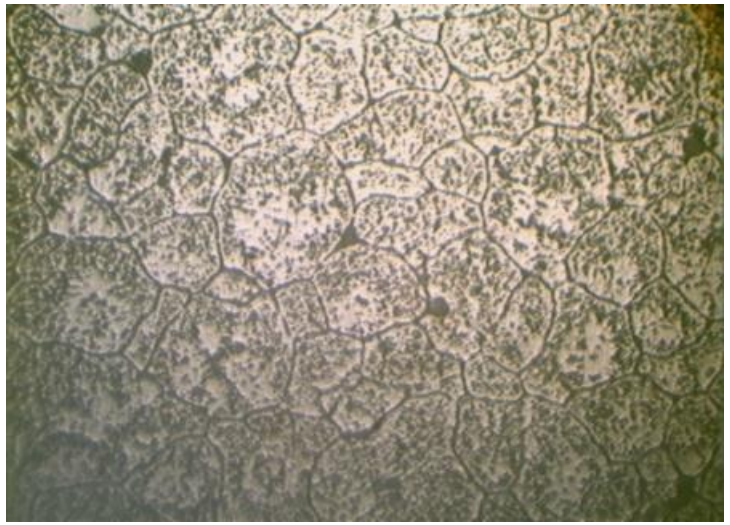
Experimental Procedure

- Mechanical Testing
  - Tensile Test

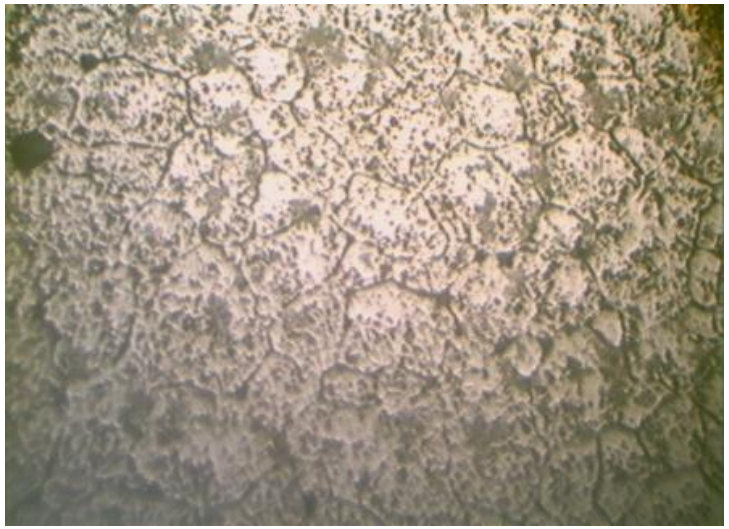
- Microstructural Analysis
  - Grain Size Measurement, Phase Analysis

Results

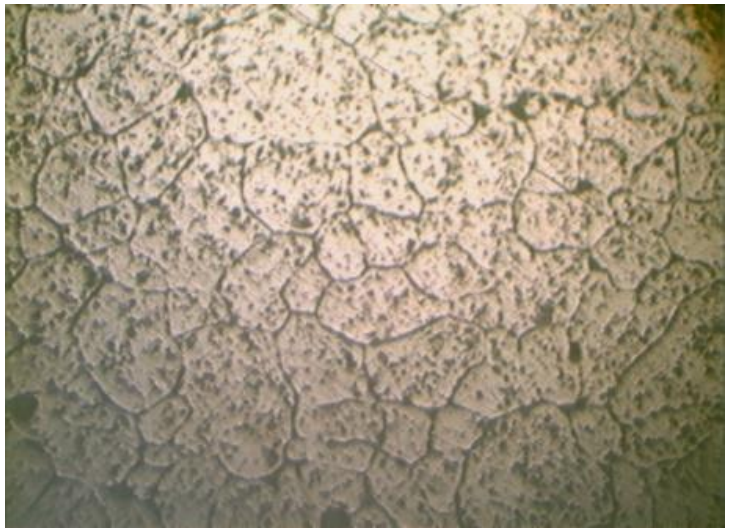
- Microstructure of Specimens with Vibration (Specimen 1,2,3)



1x T6 Heat Treatment



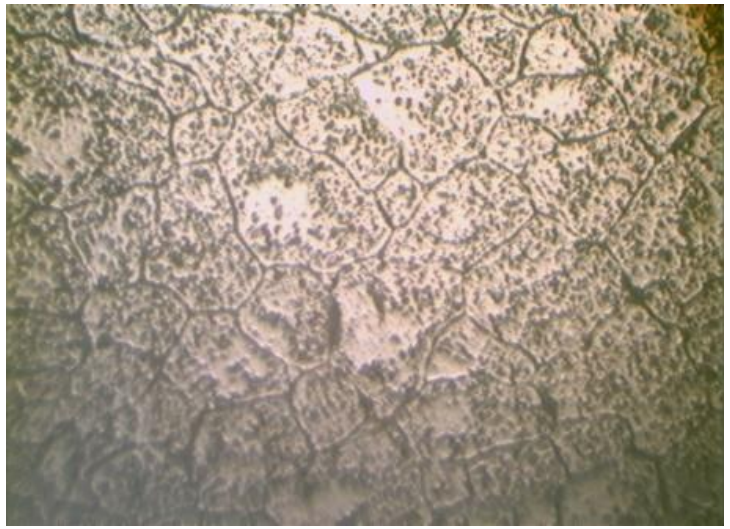
2x T6 Heat Treatment



3x T6 Heat Treatment

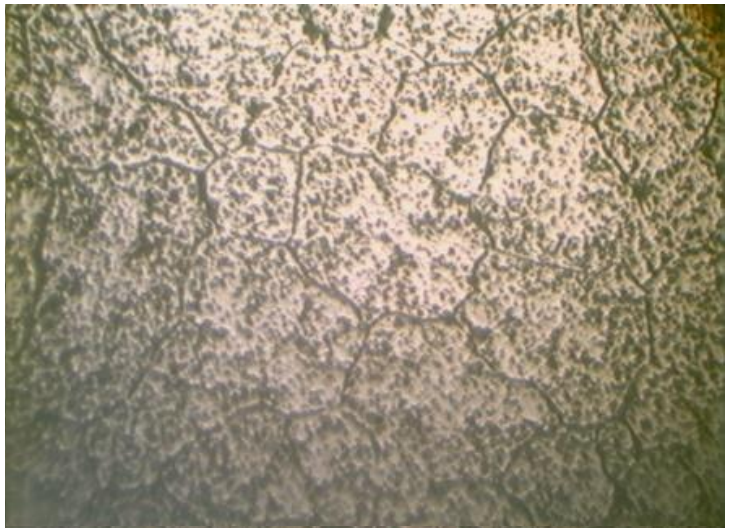
Results

- Microstructure of Specimens without Vibration (Specimen 4,5,6)



1x T6 Heat Treatment

2x T6 Heat Treatment



3x T6 Heat Treatment

Results

- Grain Size Measurement

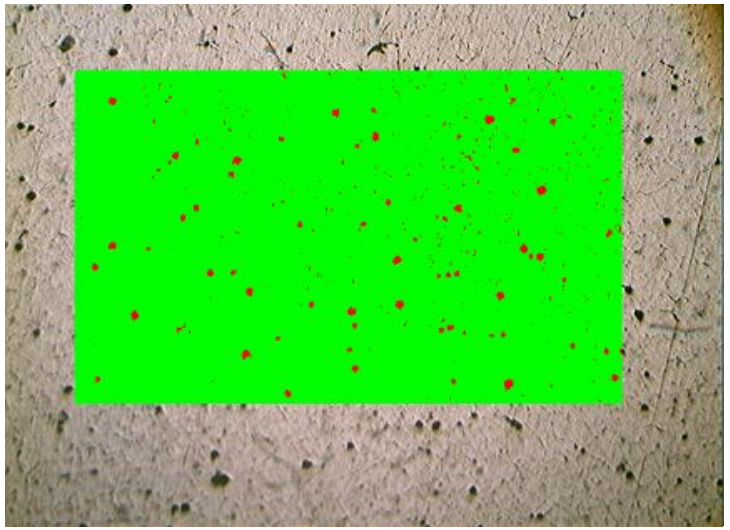
Specimen	1	2	3	4	5	6
Average Grain Diameter (Microns)	31.64	35.75	35.57	38.51	37.02	43.86

- Phase Analysis

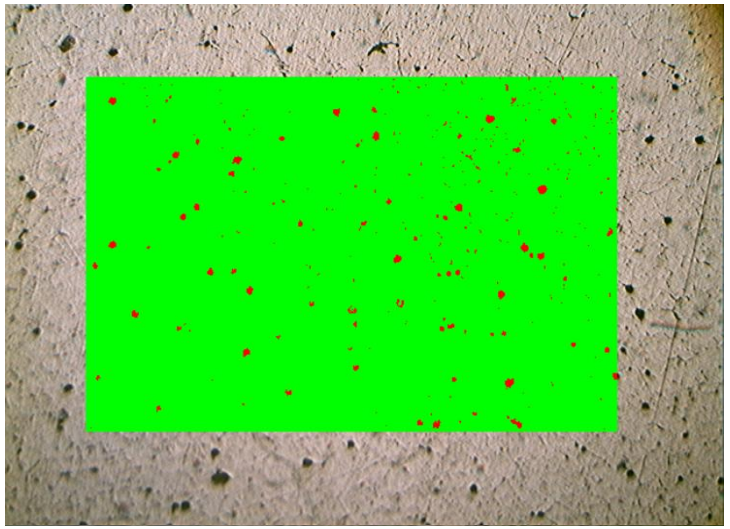
Specimen	1	2	3
Precipitiates(%)	1.625	1.263	0.75

Results

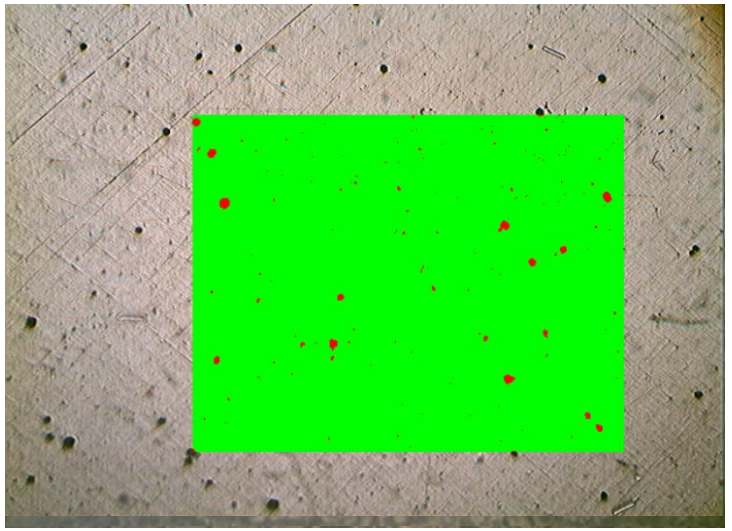
- Intermetallic Compounds (Specimen 1,2,3)



1x T6 Heat Treatment



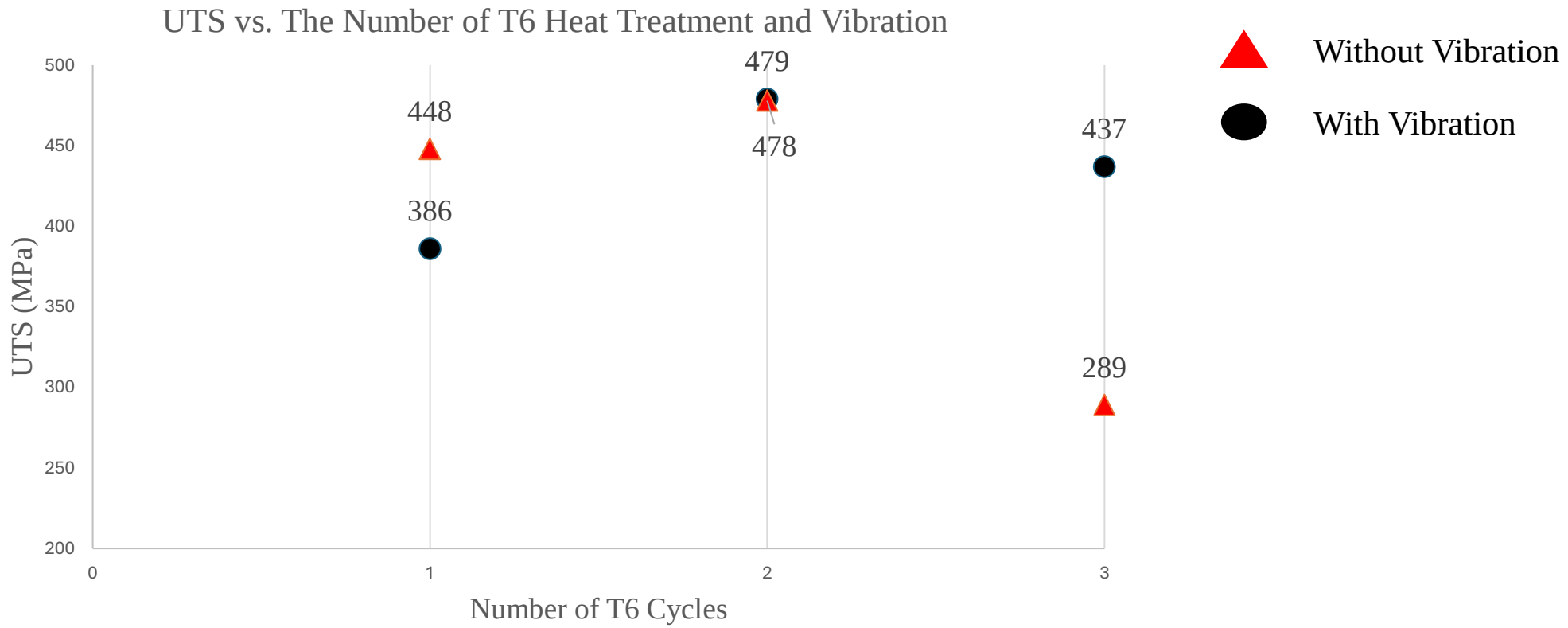
2x T6 Heat Treatment



3x T6 Heat Treatment

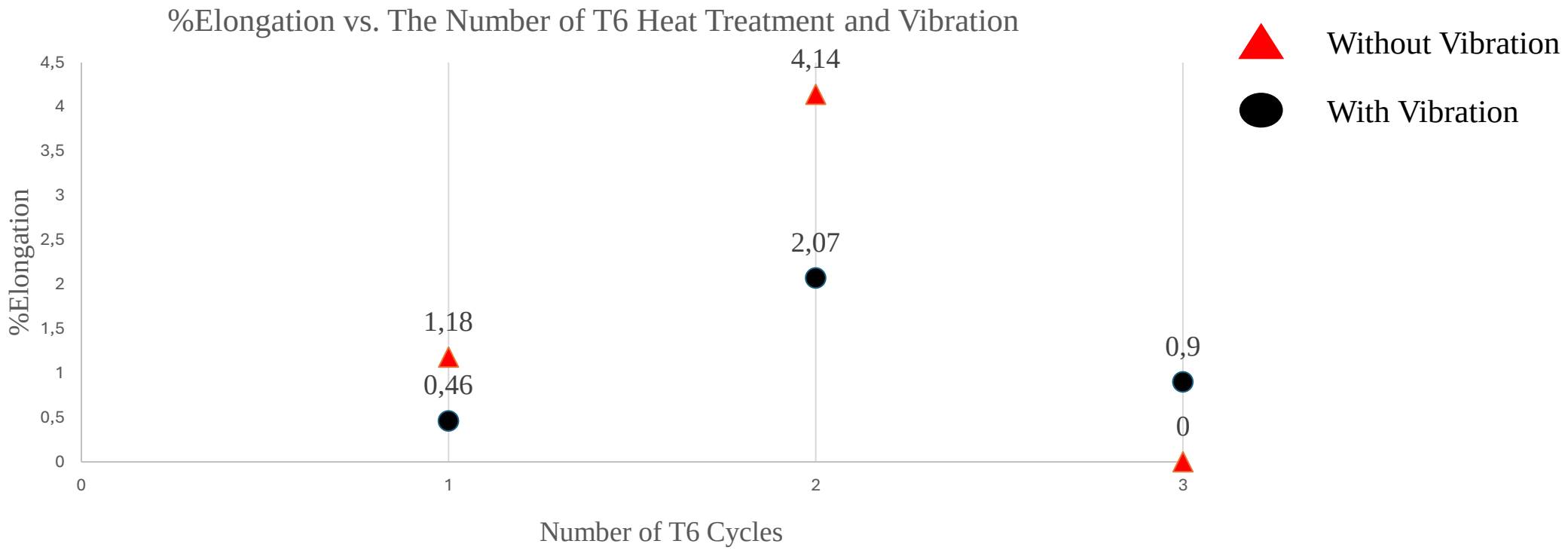
Results

- Tensile Test



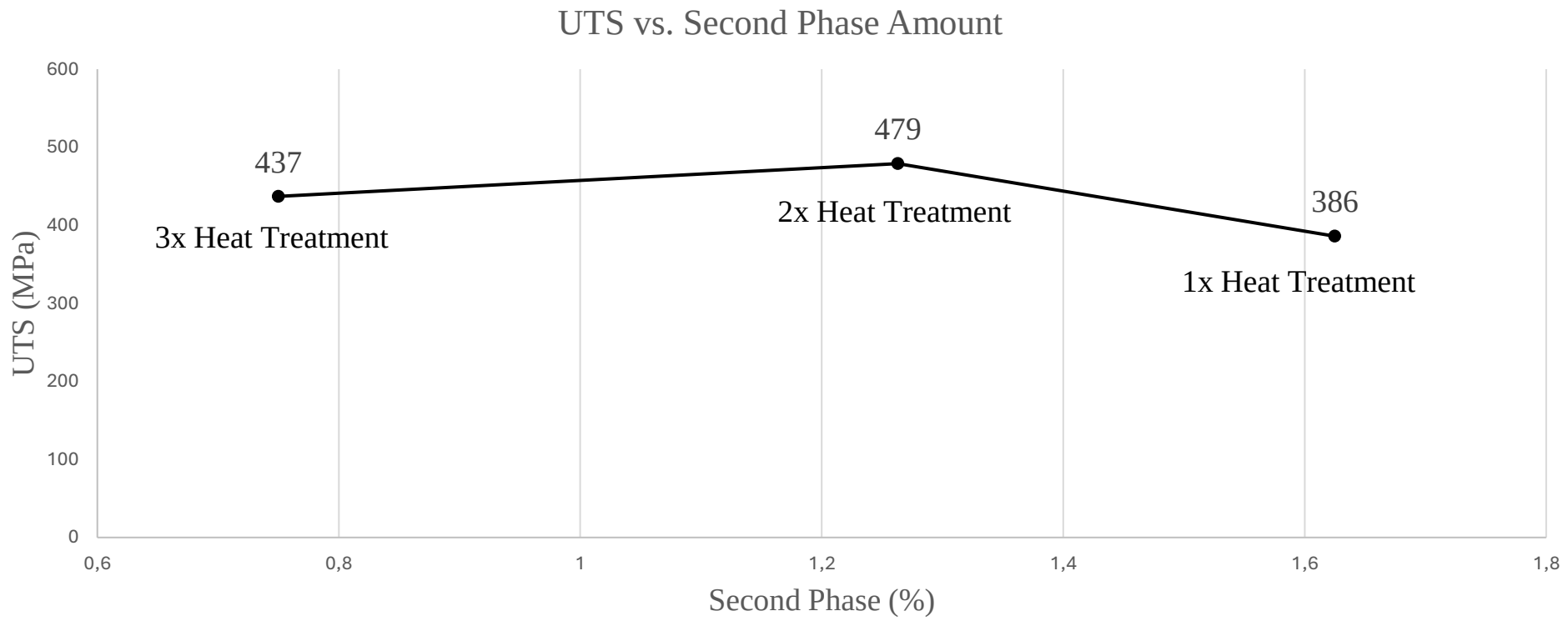
Results

- Tensile Test



Results

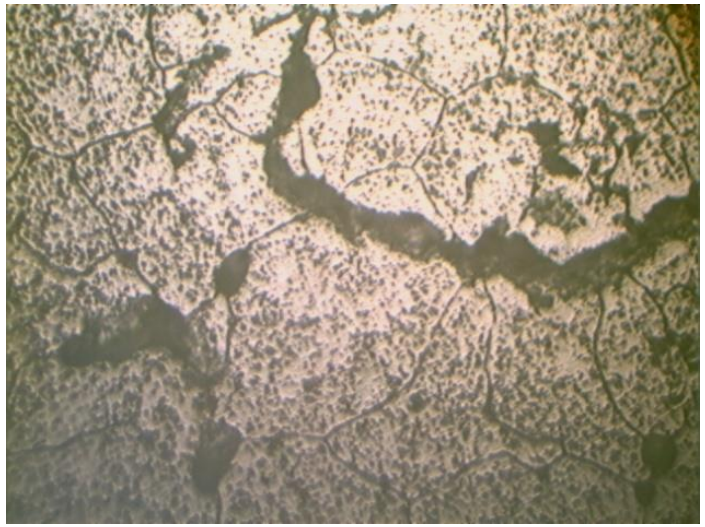
- UTS and Second Phase



Results

- Possible Reasons for Differences Observed in The Microstructure of Some Specimens

Chinese Script Morphology in Specimen 3



Crack in Specimen 6

Fracture Surfaces of Specimen 3 and Specimen 6

Conclusion

- The benefit of vibration application was achieved for the specimens produced by vibration and two times T6 heat treatment.
- Mechanical properties in terms of UTS values increased with both vibration application and T6 heat treatment.
- Vibration application was effective for all specimens yielding smaller grain sizes for these A201 alloys.
- Mg_2Si-Chinese script morphology was unexpectedly observed in the specimen produced by vibration application and three times T6 heat treatment. More experimental work must be done to reveal the formation of this morphology during squeeze casting.

Recommendations

- There is a possible formation of blistering in the T6 samples that were heat-treated three times. This must be studied using more samples produced by vibration and without vibration.
- Interdendritic porosity formation must be investigated in all T6 heat-treated samples.
- The fracture surface must be examined to reveal the existence of enlarged pores or brittle intermetallics.

THANK YOU ALL FOR LISTENING!