



Óbuda University, Doctoral School on Material Science and Technology.

Testing in Semi-Solid Rheocasting (SSR)

PhD Student

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Supervisors by

V. Gonda and Réger Mihály

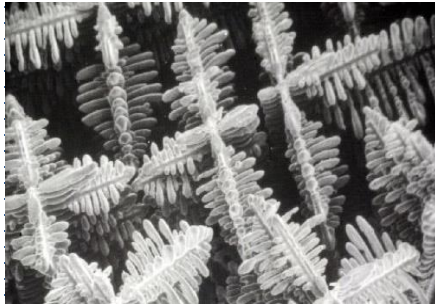
22. Jun. 2018

Second Semester

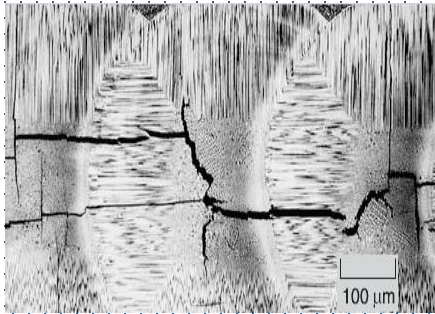
Outline

- ✓ **Non-Dendritic Structure**
- ✓ **Previous Work**
- ✓ **Aluminum Alloys**
- ✓ **Process Window**
- ✓ **The SSR Feedstocks**
- ✓ **Results and Conclusion**
- ✓ **Results of the Actual Semester**
- ✓ **Activity in This Semester**
- ✓ **Future Research Plan**

Non-Dendritic Structure

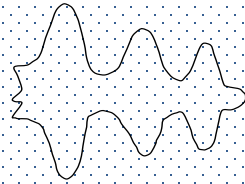


Dendritic structure of material

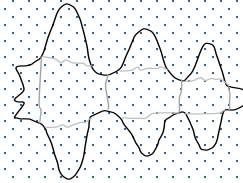


Failure Arm Dendritic structure

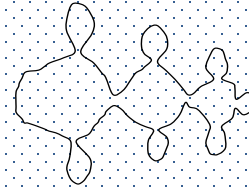
Microstructural changes



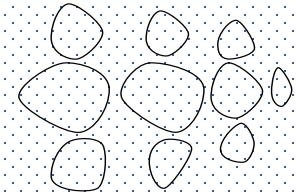
a



b



c



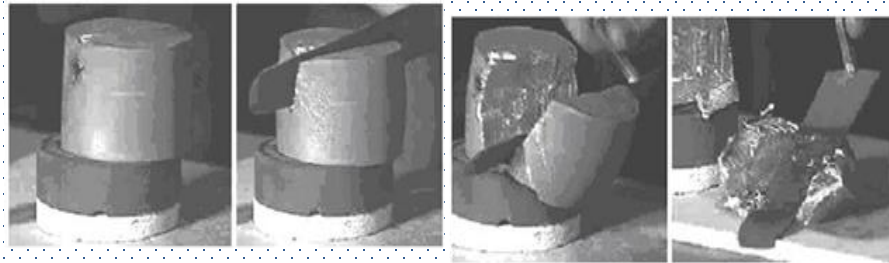
d

Dendritic arm structure

Spheroidal shape

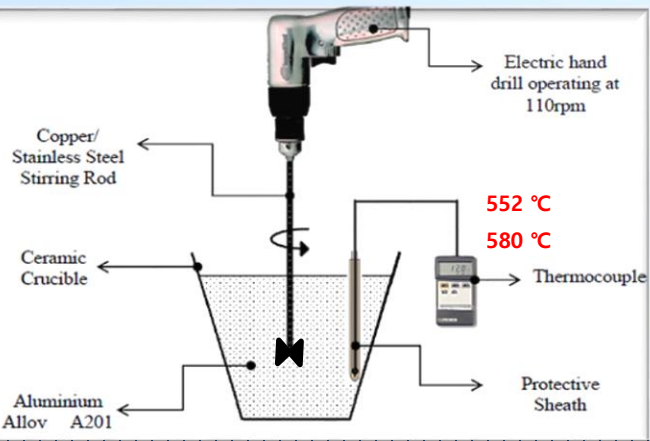
(a and b) The shear stresses change the shape of the solid particles from dendritic (c and d) to globular

What is Semi-Solid State?

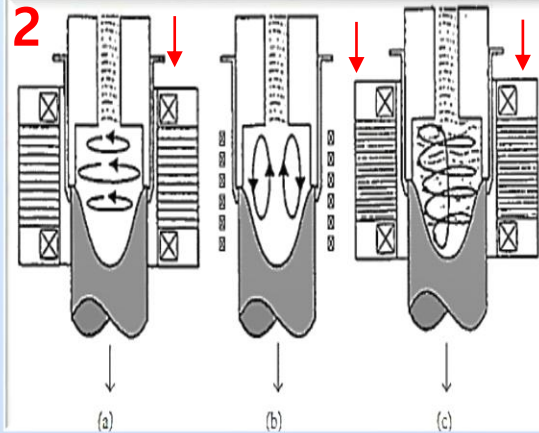


Previous Work

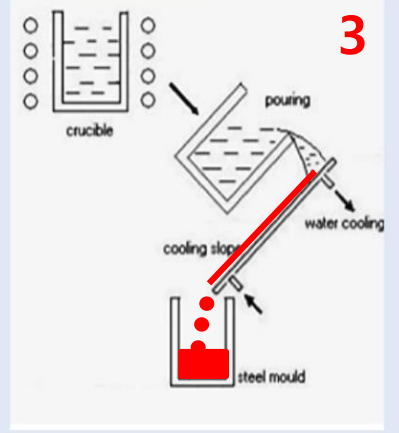
1



2



3



4

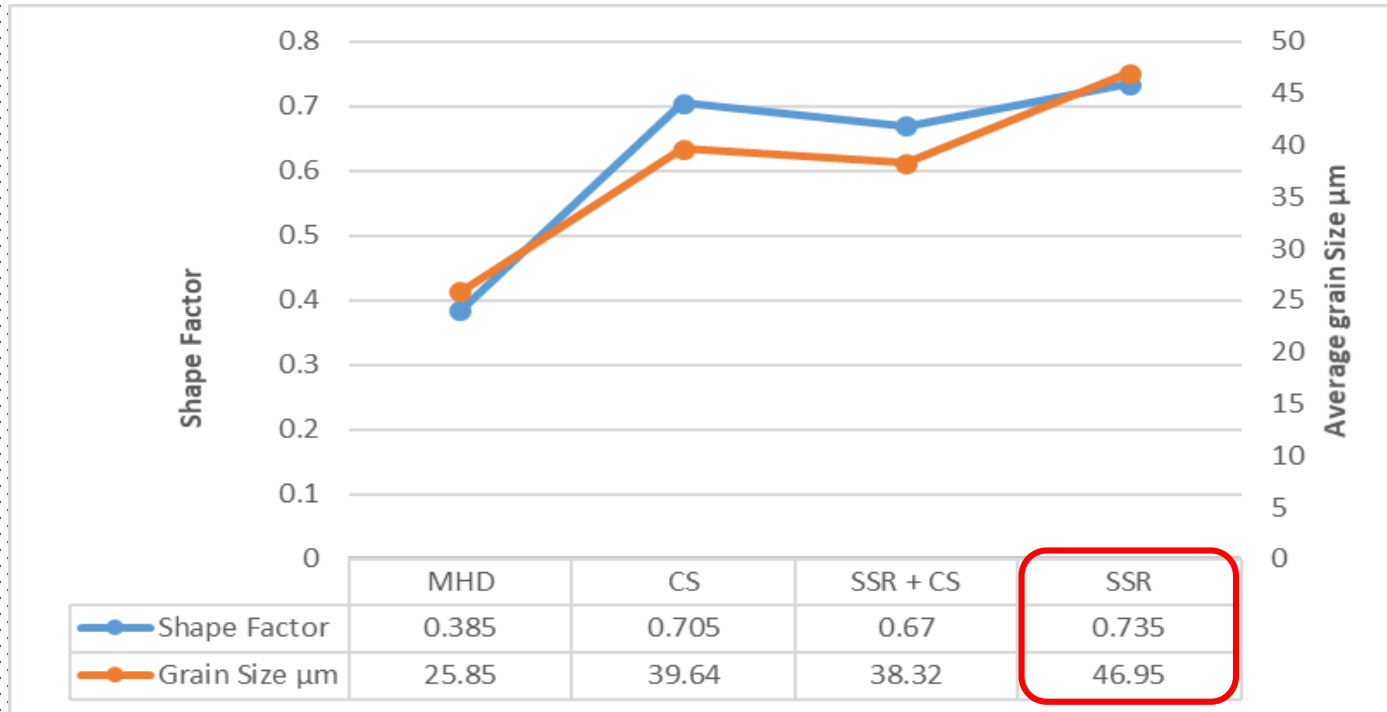
1. Semi-Solid Rheocasting (SSR) Method

2. Magneto Hydrodynamic (MHD) Method

3. Cooling Slope Method

4. SSR with CS Method

Previous Work



Shape Factor and Grain size of variance types of Alloy A201

Aluminum Alloys

The first one Pure Aluminium is contain 99% of aluminum and the second one is a higher Silicon grade

wt%	Al	Si	Mg	Ni	Ti	Mn	Cu	Zn
A4032	Bal.	12.2	1.0	0.9	-	-	0.9	-
Pure Al.	99%	-	-	-	-	-	-	-

Advantages of Pure Aluminium :

- High thermal and electrical conductivities,
- Low mechanical properties,
- Excellent workability,
- Excellent corrosion resistance

Application of Pure Aluminium:

- Electrical and chemical fields
- Foil and conductor cables

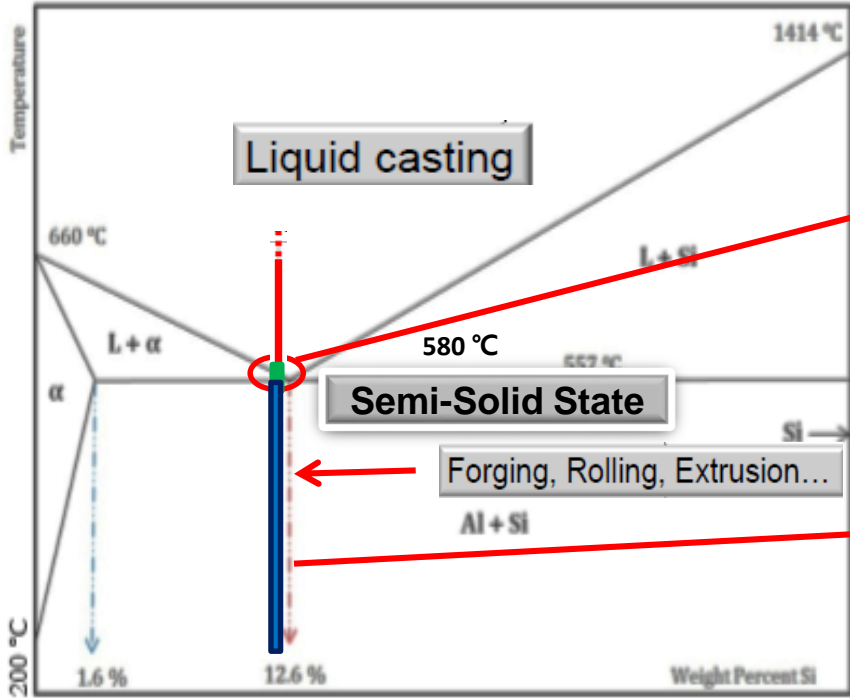
Advantages of Aluminium silicon alloy:

- High mechanical properties,
- Low coefficient of thermal expansion,
- Good wear resistance

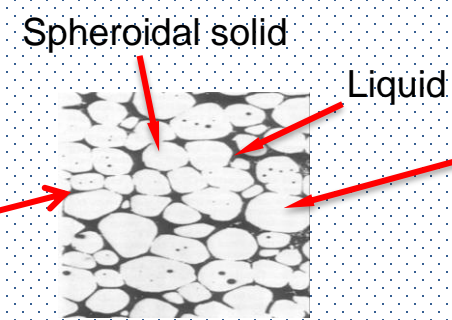
Application of Aluminium silicon alloy:

- Welding wire and as brazing alloys for joining aluminum
- Automotive, forged engine pistons

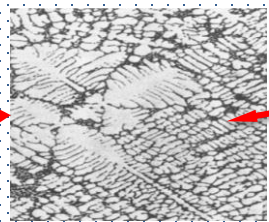
Semi-Solid Process Window



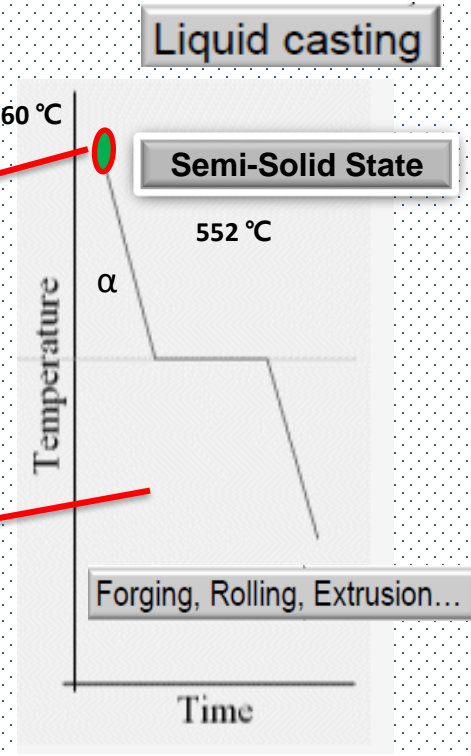
12.2 of Si →
Al Silicon Phase diagram



Non-Dendritic Microstructures



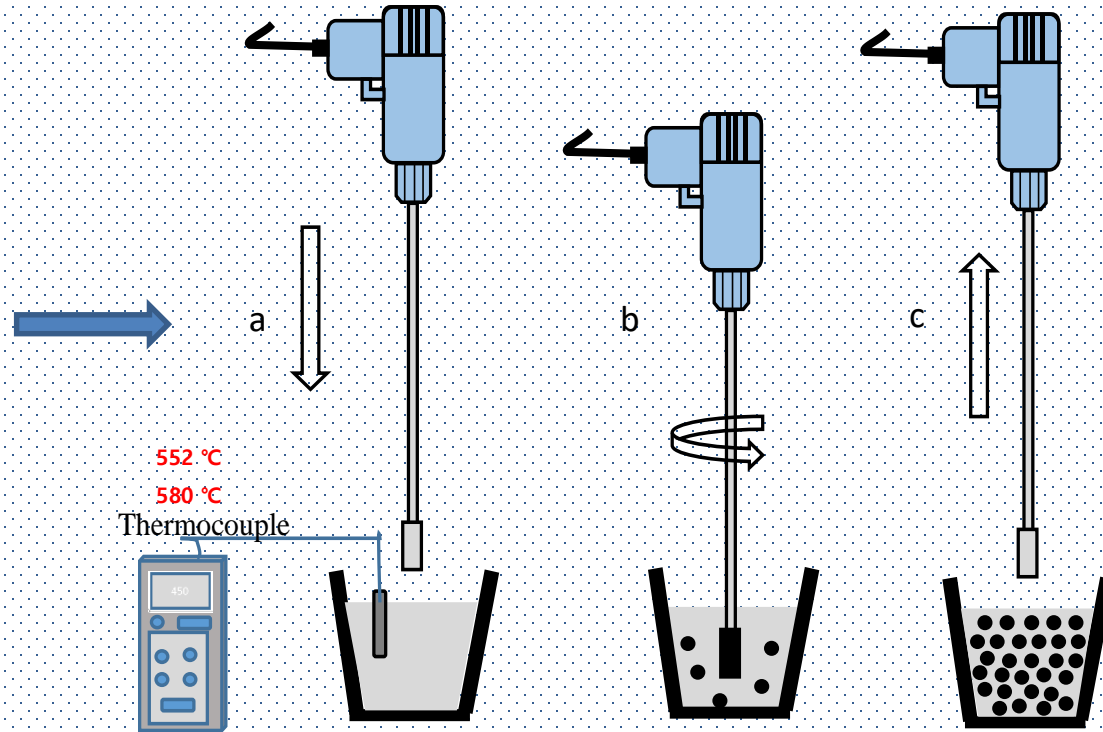
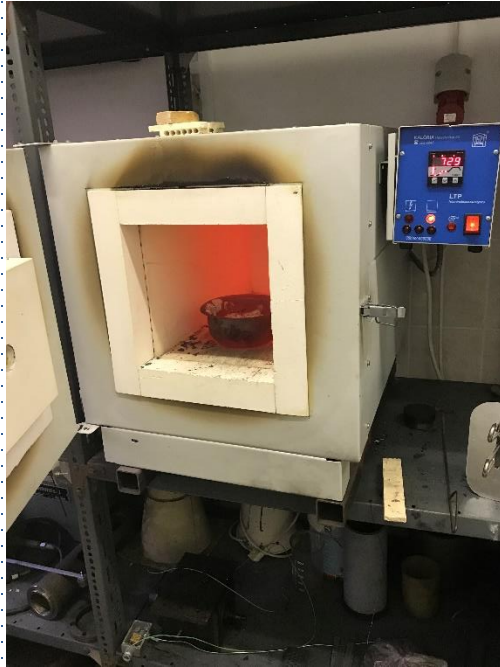
Dendritic Microstructure



Pure Al Phase diagram

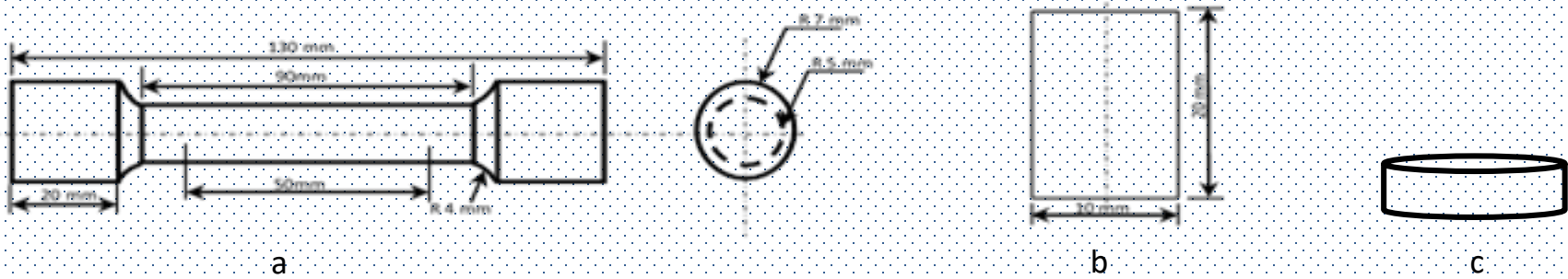
How can get Semi-Solid Rheocasting ?

The SSR feedstocks



Rheocasting process active in the present work: (a) solid block of the same alloy prepared in advance, attached to a stainless steel rod, (b) dissolved in the melt with simultaneous stirring action, and (c) the slurry thus produced.

Results and Conclusion



(a) samples of tensile test; (b) samples of compression test made and (c) samples of hardness test



Tensile and Compression sample

Results and Conclusion

• Compression Test



Compression Test Machine



Pure Al casting



Max. Force 2.2 KN



Pure Al Rheocasting



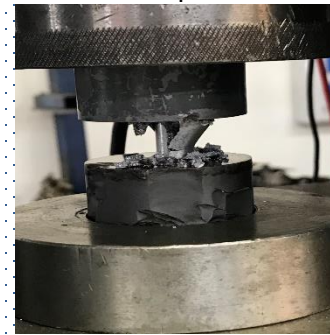
Max. Force 3.3 KN



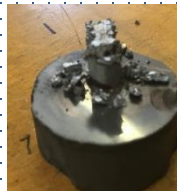
Al Silicon casting



Max. Force 3.5 KN



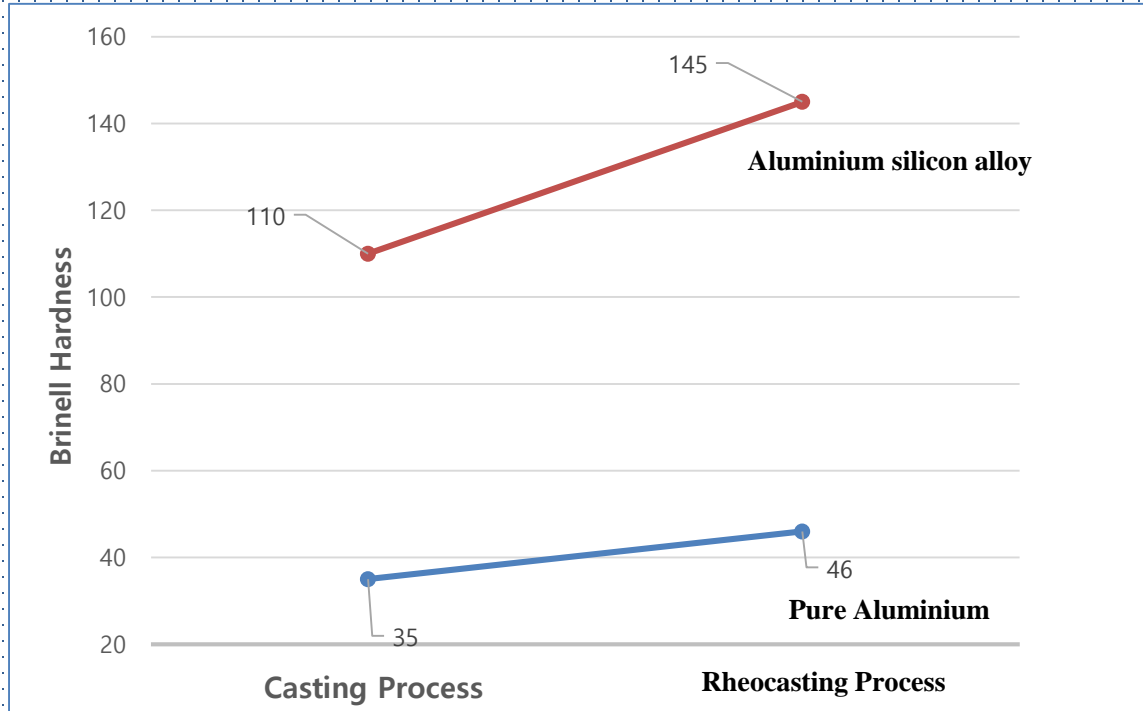
Al Silicon Rheocasting



Max. Force 4.3 KN

Results and Conclusion

- Brinell Hardness Test



- Tensile Still wok on it

Results of the Actual Aemester

1. Materials Investigations I,Two Parts:

- I. Scanning Electron Microscopy (SEM) and Atomic Force Microscopy (AFM) by Dr. Judit Telegdi
- II. Fourier-transform infrared (FTIR) and Liquid Chromatography/Mass Spectrometry (HPLC/MS) by Dr. Telegdi Lászlóné

2. Finite Element Modeling of Materials Technologies by Dr. Viktor Gonda

3. Analysis of Damage Processes of Structural Materials by Dr. Tunde KOVACS

Activity in this Semester

✓ Conference and Publications paper :

Participated in SSSCC 2018 : Smart, Sustainable and Safe Cities Conference my topic was (Evaluation of microstructure and mechanical properties for non-dendritic feedstocks of an A201 aluminium alloy) in (25.05.2018)

✓ Teaching activity the Subject was Material Science

✓ Seminar in Materials Sciences

✓ HAAS & ORE-BGK CNC Conference

✓ Supervising Exam.

✓ Lecture.

✓ Laboratories Work.

✓ Visit Galleries:

- Automotive Hungary

Future Research Plan

- My Future Study will be about **behavior another aluminum alloy (5xx.x) in High Temperature.**

Work will be about mechanical properties such as **ductility** and **strength**.

Thank you.....