

FatSS

Aluminium Semi Solid Gjutning, med fokus på utmattningsegenskaper och defekter

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VOLVO

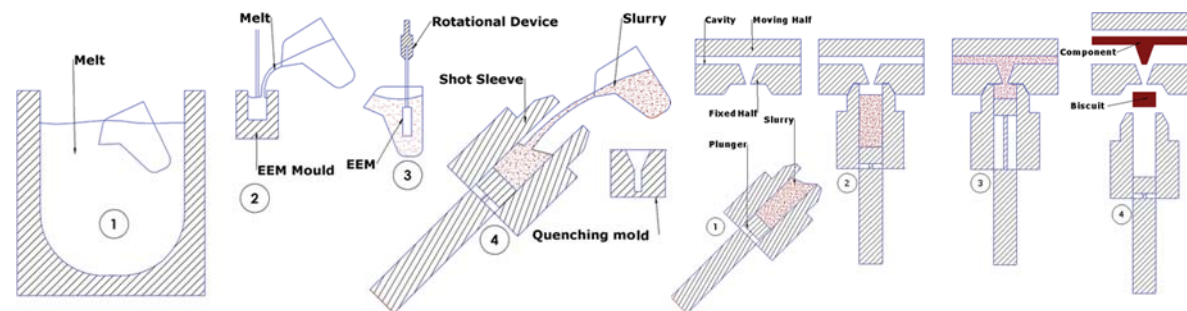
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VINNOVA

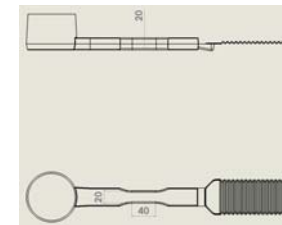
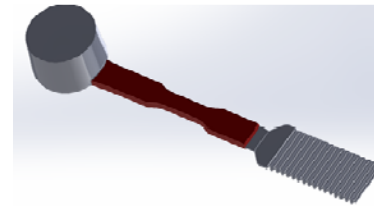
Background

- The project goal is to provide relevant mechanical properties and fatigue data for design Semi-Solid Metal (SSM) casting structural components.
- In SSM casting the melt is partially solidified, where small near globular grains are surrounded by melt.
- Rheometal™ process was used to produce SSM castings.



SSM casting

- A356 aluminium alloy.
- SSM castings were tested in as-cast, T5 and T6 conditions.



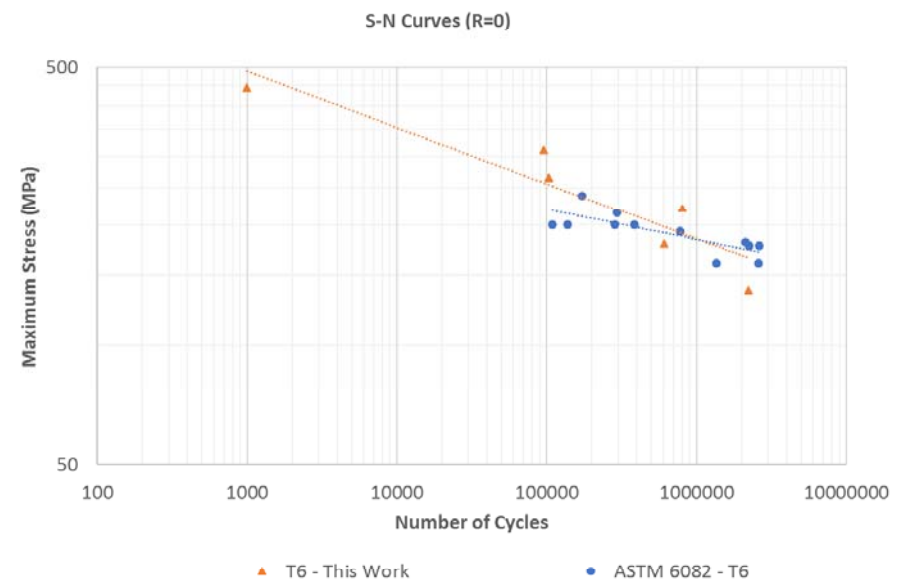
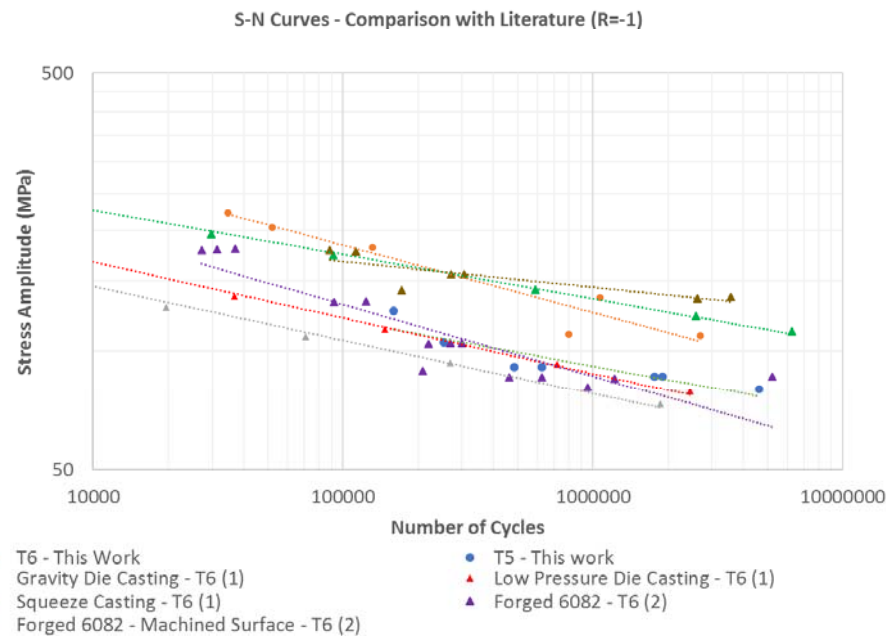
- Tensile testing.

	$R_{p0.2}$ [MPa]	R_m [MPa]	A [%]
<i>As-cast</i>	99±2	205±9	8.9±2.2
<i>T5 Heat Treated</i>	136±2	215±12	3.0±2.8
<i>T6 Heat Treated</i>	223±6	275±9	6.2±2.4

- Four-Point bending fatigue tests performed at Volvo Group AB.



Results – Fatigue Properties



[1] D.P.A. Blackmore, The effect of casting process and surface finish on the strain-life fatigue properties of EN 1706 AC-42100 (AlSi7Mg), Present. HBM-nCode Semin. "Austen 8 Sourc. Mater. Prop. CAE Simulation", Rotherham, 7th April 2011. 42100 (2011).

[2] P.A. Blackmore, Z. Lu, K. Rawlings, Surface defects created by the forging process and their effects on the fatigue performance of a 6082 Al-alloy, Fatigue Des. Mater. Defects, FDMD II - JIP 2014. 12 (2014) 1–3. doi:10.1051/mateconf/20141205002.

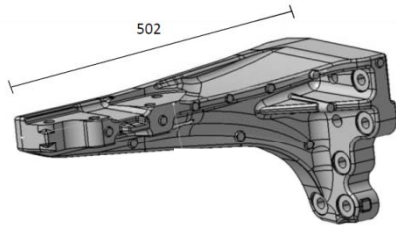
Results Summary

- Mechanical properties are superior for T6 initial condition compared with T5 and as-cast conditions.
- The T6 heat treated castings present a higher fatigue strength compared with T5 and as-cast initial conditions.
- SSM casting have potential to produce light weight components for structural purposes.
- SSM casting fatigue properties are close to forged and squeeze casting properties
- Demonstrator test on a Volvo Penta “fork” show that the fatigue requirement was fulfilled, however there is still potential for further improvements (reduce oxides and shrinkage).



Future steps

- Volvo Trucks has recently introduced chassis parts in semisolid with T5 heat treatment in production. One example of part is a muffler anchorage.



Muffler anchorage 9.2 Kg

- The next step is to introduce parts for axle suspensions. T6 treatment will be required and we also need to be able to produce a bigger slurry volume, 20-25 Kg will probably be needed.



Questions?