Excellent welding results of Rheo parts.

Mechanical testing of welded joints

The subframe is a large component in a car and is important for meeting the cost, weight and sustainability targets. A light and cost-effective aluminium subframe is therefore interesting for future use. The joining of high-pressure die casted components and extruded aluminium beams has been investigated in order to develop a geometrically complex and lightweight subframe.

This is the result from a Bachelor thesis conducted by **Oscar Samuelsson** and **Isak Tillberg** from Chalmers University of Technology.

The conclusion of this investigation is that Rheocasting enable welding with similar results as achieved in sheet metal welding. Rheocasting can help increase the weldability of the material and increase the bonding strength of the joint.

Comptech has provided this research with Rheocasted parts for testing

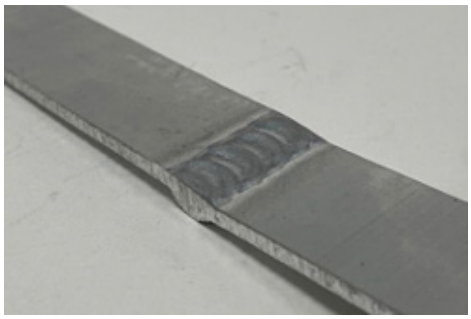
Material used for testing

- Parts in aluminium alloy ENAB 44300, produced by HPDC with vacuum assistance.
- 2,5 mm thick Rheocasted plates in aluminium alloy ENAB 42000 from Comptech.
- Extruded aluminium flat bar, alloy EN-AW 6063-T6, thickness 3 mm and 4 mm.

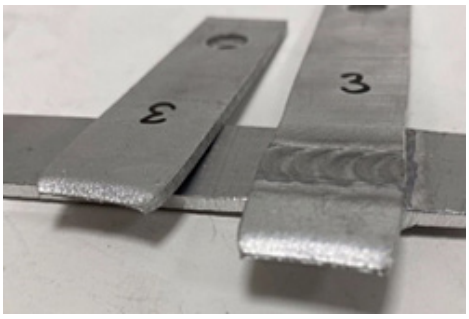
Preparation

The components were cut into plates of suitable size and butt welded using a TIG-welding process (ESAB 2200i). The plates were prepared by cleaning with a stainless wire brush and degreased using denatured alcohol. They were then chamfered to form a single v-butt joint with a 1mm root face, the welding was done in one pass, achieving full penetration.

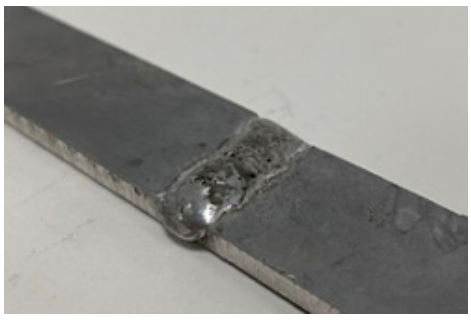
Results from the testing of welded joints and tensile testing



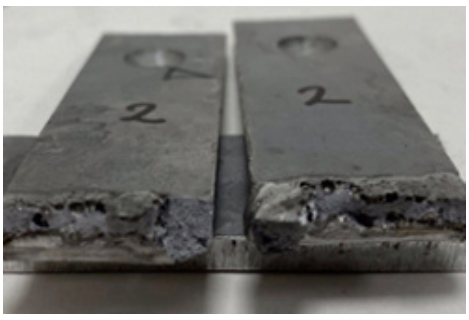
EN-AW 6063-T6 (3mm) welded together



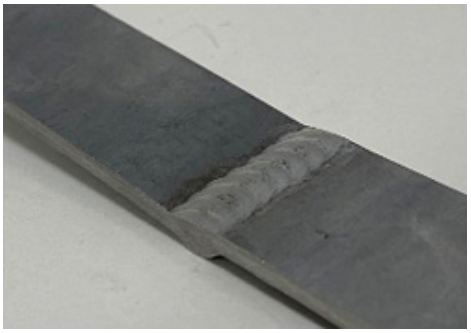
Tensile testing



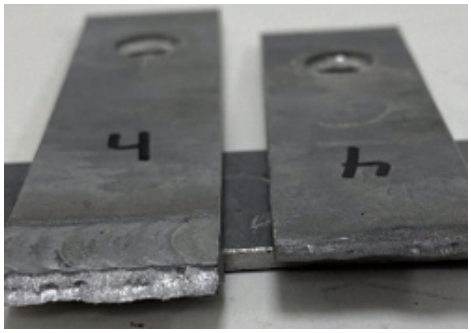
ENAB 44300 (V-HPDC) welded together



Tensile testing



ENAB 42000 (Rheocasting) welded together



Tensile testing

Compilation of tensile testing

Three test pieces of each test material were put through a tensile test.

Test material:	Breaking force:
EN-AW 6063-T6 to EN-AW 6063-T6 (3 mm):	
Test piece number: 2	8,216kN
Test piece number: 3	8,131kN
Test piece number: 4	8,375kN
Average value	8,241kN
EN-AW 6063-T6 (3 mm) to ENAB 42000 (rheocasting):	
Test piece number: 1	8,829kN
Test piece number: 2	8,922kN
Test piece number: 3	8,871kN
Average value	8,874kN
EN-AW 6063-T6 (4 mm) to ENAB 44300 (V-HPDC):	
Test piece number: 1	7,782kN
Test piece number: 2	6,047kN
Test piece number: 3	8,168kN
Average value	7,332kN
ENAB 44300 (V-HPDC) to ENAB 44300 (V-HPDC)	
Test piece number: 1	5,984kN
Test piece number: 2	5,201kN
Test piece number: 3	6,142kN
Average value	5,776kN
ENAB 42000 (rheocasting) to ENAB 42000 (rheocasting)	
Test piece number: 2	9,567kN
Test piece number: 3	8,716kN
Test piece number: 4	8,521kN
Average value	8,935kN

Conclusion:

Welding 6063-T6 pieces together was no problem, and the penetration was very good. No porosity was encountered when welded or when it was cut apart.

Welding ENAB 44300 (V-HPDC) together caused a lot of problems as it was a lot of pores and impurities in the weld and penetration was not great.

Welding together the two Rheocasted pieces, the material melted easily, and the bond was good. The tensile testing of the joint showed good result as the tests experienced forces of 9,567kN, 8,716kN and 8,521kN before the breaking point of the sample.

COMP tech Rheocasting