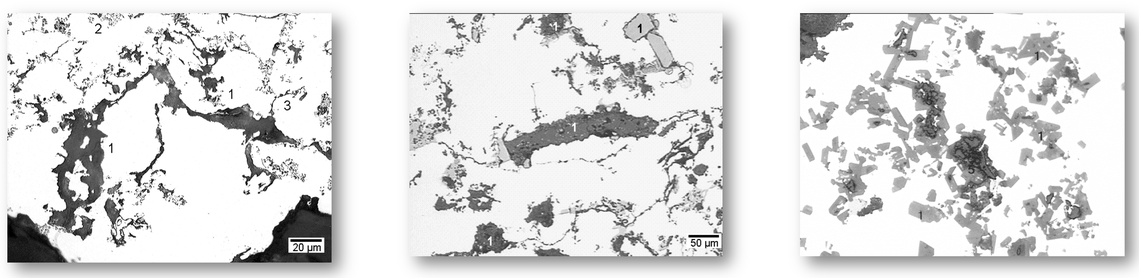
P4 – Melt Cleanliness

AMAP Advanced Metals and Processes

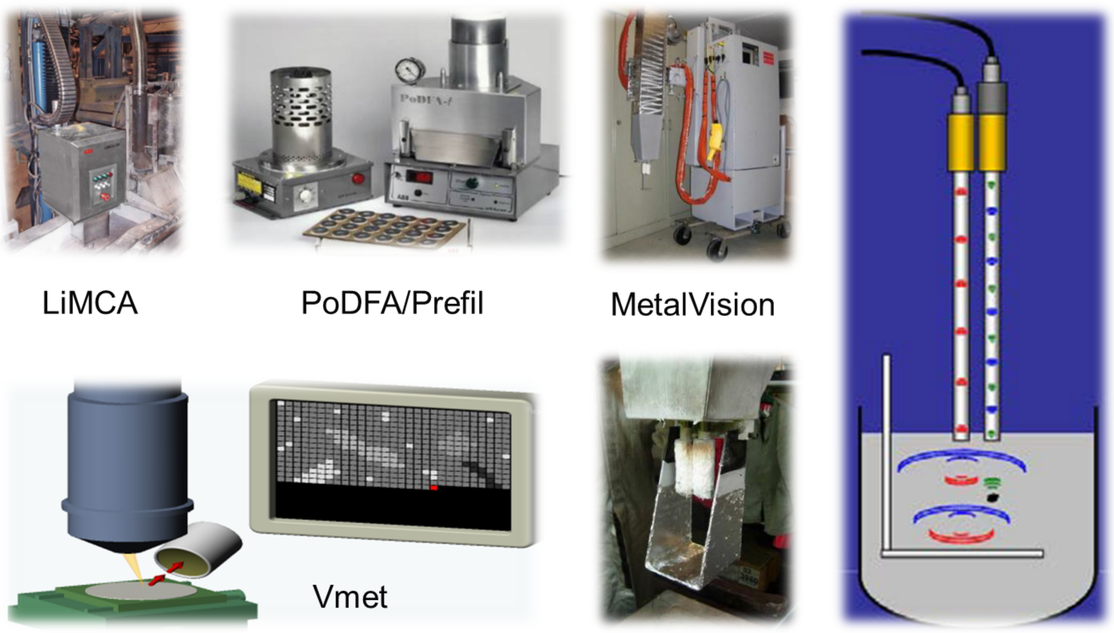
Executive Summary

Rolled aluminum products tend to have lower final thicknesses and increasing demands on surface quality. Trends of lightweight cast components also lead to thinner wall thicknesses and more complex geometries. At same time mechanical and thermal stresses rise. The increasing demands can only be met through continuous development of materials and highest quality products. Materials which have a low impurity content compared to contaminated and have defect-free and homogeneous surfaces have significantly better mechanical properties and show even under dynamic loading a longer lifetime and improved fatigue strength. Inclusions such as aluminum carbide Al_4C_3, alumina Al_2O_3, titanium boride TiB_2, magnesium oxide MgO and spinel $MgAl_2O_4$ are in this regard the most common types of undesirable impurities in aluminum melts.



Most common impurities in aluminum melts. Left Al_2O_3, center MgO, right Al_4C.

To meet the high requirements of the product and material properties reliably, it is imperative to characterize the melt in terms of their impurities and assign a defined purity. Accordingly the appropriate melt purification and treatment process parameters have to be derived. Measurement systems are currently available like LiMCA, PoDFA and MetalVision, but these are not very practical, fast, accurate and mostly not reliable for continuous quality control in production.



Common applied measurement techniques for impurity detection in aluminium.

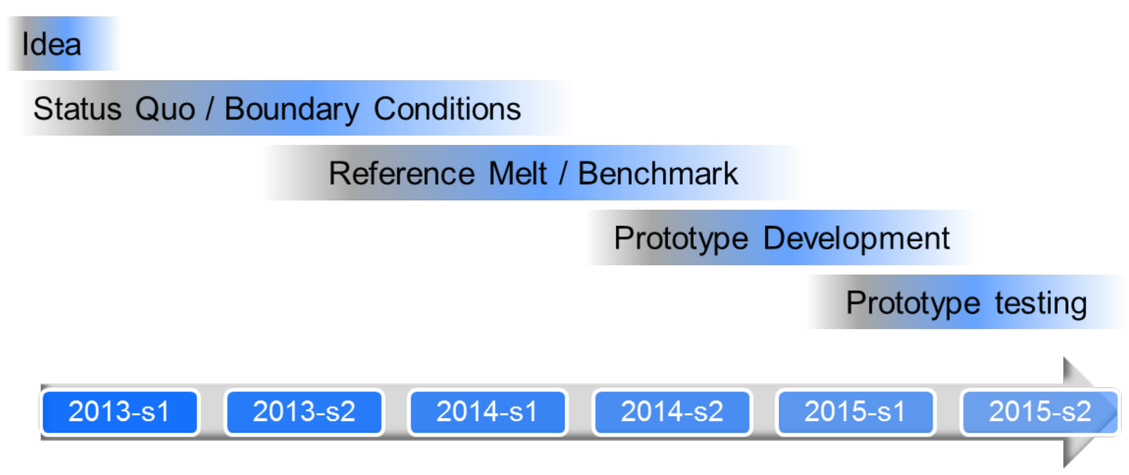
Scope

The melt cleanliness has been improved in the last decades by the development of melt treatment and filtration technologies. However there are still improvements expected in the following areas:

- Formation mechanisms of critical inclusions
- Evolution of inclusions from their formation to the solidified product
- Quantification of inclusions in the melt
- Impact of inclusions on the properties of the final product

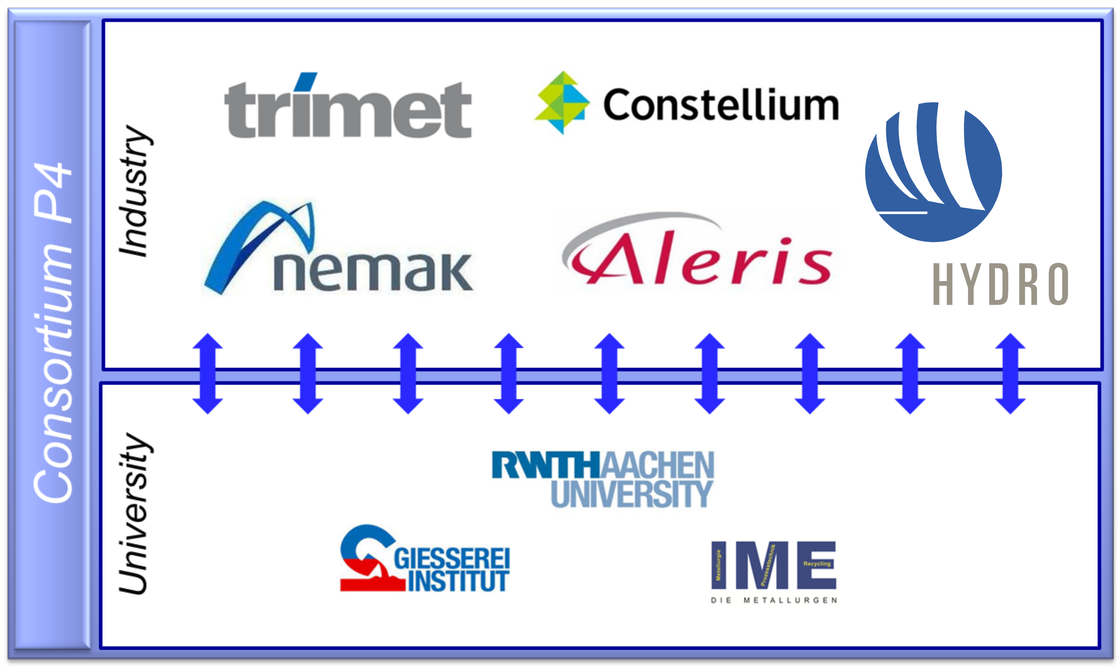
Within the first 3 years of the project the consortium will focus on the development of the quantification of inclusions in the melt and its relation to the specific inclusion. Within the project several approaches regarding the measurement method will be developed and evaluated.

Timeline



Consortium

The international project consortium consists of five industrial partners: Aleris, Constellium, Hydro, Nemak and Trimet and two institutes of the RWTH Aachen University, the Foundry Institute GI and the Institute of Process Metallurgy and Metal Recycling IME.



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