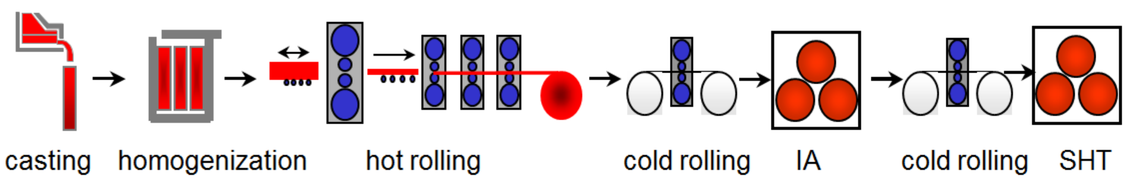
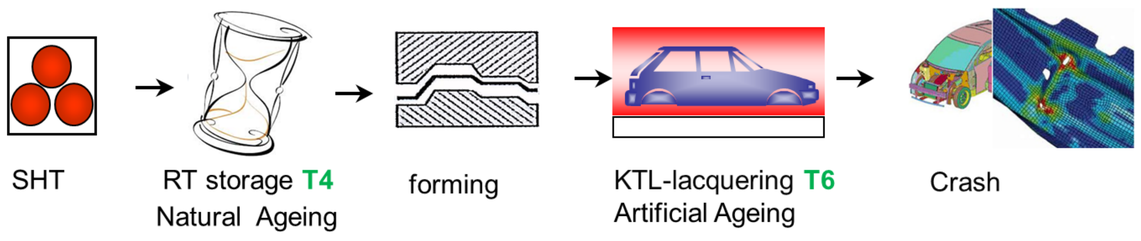
P1 – Modelling of components made of rolled and annealed sheets with particular properties for the automotive industry

AMAP Advanced Metals and Processes

Executive Summary

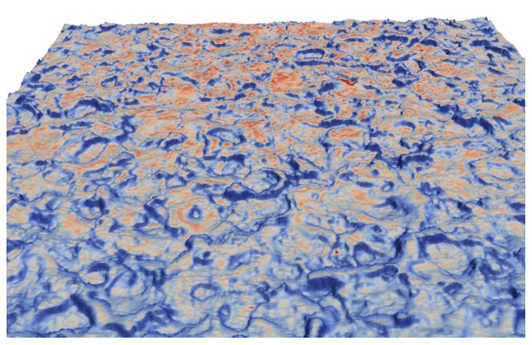
The product properties of engineering parts are determined by the microstructure, which is dependent on the processing. In order to optimize the final properties, it is required to describe the whole process on the level of physical material models.
Overall goal of the project is the linking of existing simulation software along the processing chain of rolling of Aluminium, from a cast ingot to the finished product and also its application behaviour. In order to simulate the related properties for the product at the end of the process chain, the main changes of the microstructure should be represented by the models. In addition to the existing models, there are new models to be investigated which are capable of connecting the simulated microstructure to macro mechanical properties.



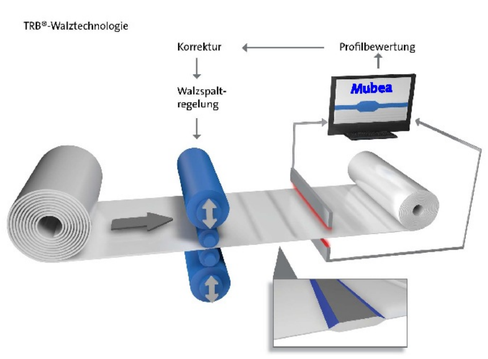


Process Chain for automotive alloys

A further important property is the sheet surface quality and its impact on friction both during the rolling process and during subsequent forming.
Therefore the change of surfaces during the rolling process will be improved with respect to a good formability during deep drawing. One means of improvement is the optimisation of dedicated topographies like EDT.
Next to the conventional rolling process, which is used for outer skin parts, tailor-rolling with a variable thickness of sheets should be applied for structural parts from higher strength aluminium alloys.



EDT surface



Schematic drawing of tailor-rolling

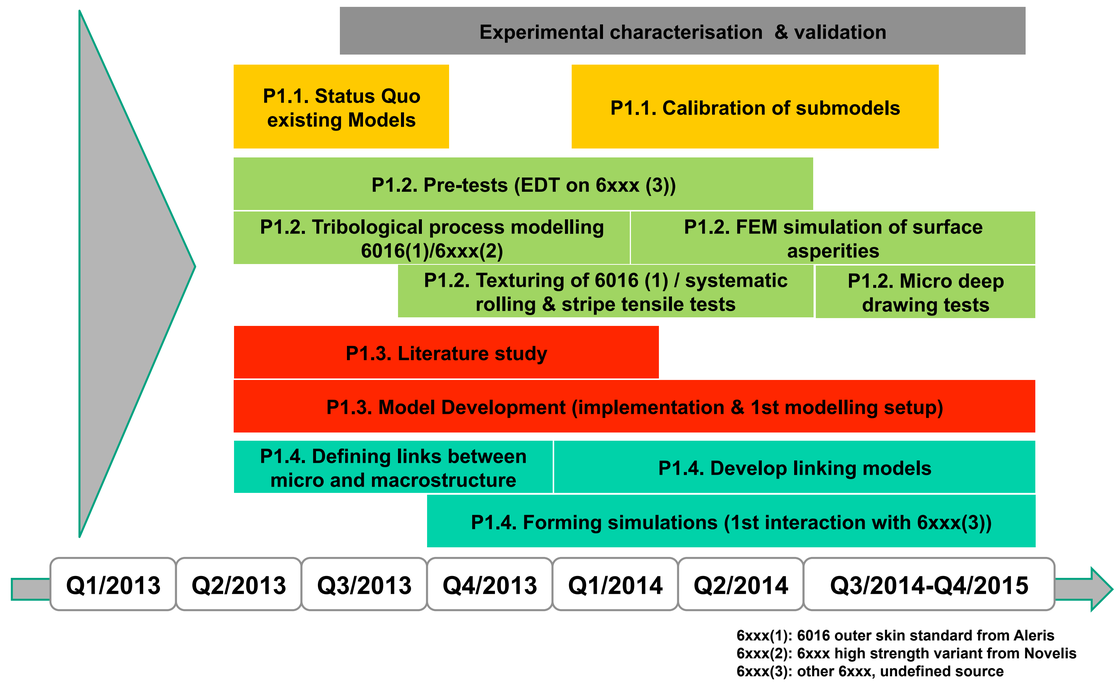
Scope

An important long term objective of this project is that the inter-process optimisation of the process chain can be performed based on the results of the through process modelling. This will provide the fundamental and beneficial way to predict the final properties of the rolling product already in the early stages. Therefore an overall knowledge over the process chain is needed, which will be given by experiments to validate the simulation results.

Major Work Packages

- Hot & Cold Rolling (Application of existing models)
- Cold Rolling (with focus on forming)
- Ageing (Experiments & Modelling)
- Link microstructure-mechanical properties (focus on forming operations)

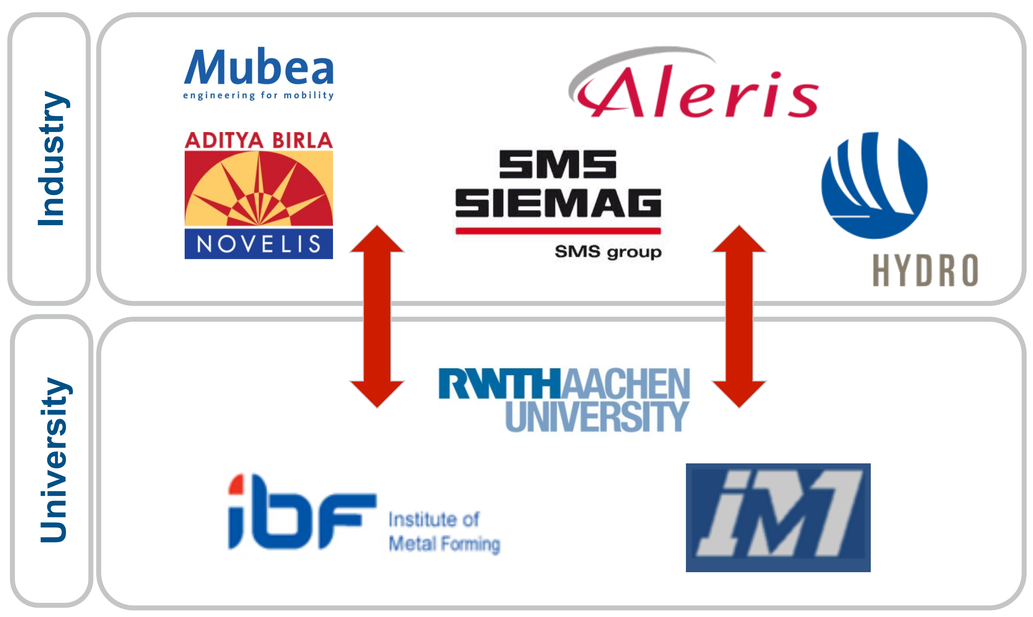
Timeline



6xxx(1): 6016 outer skin standard from Aleris
6xxx(2): 6xxx high strength variant from Novelis
6xxx(3): other 6xxx, undefined source

Consortium

The international project consortium consists of five industrial partners: Aleris, Novelis, Hydro, Mubea and SMS Siemag and two institutes of the RWTH Aachen University, the Institute for Metallurgy and Metal Physics IMM and the Forming Institute IBF.



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