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Goal
Modeling of the microstructure evolution along the whole processing chain, and to predict the mechanical properties of the final product.

Process Chain „Rolling“
- DC casting
- homogenization
- hot rolling
- cold rolling & annealing
- cold rolling / skin pass rolling

Sub-Project 1: Rolling
- Industrial processing of one AA 6016 ingot
- Material characterization and data mining after various processing steps for validation of through-process model
- Through-process model for complete processing chain

AMAP P1 full size ingot | SEM micrograph for particle quantification | evolution of experimental & simulated rolling force

Sub-Project 2: Aluminium Skin-Pass Rolling
- Investigation on the influence of strip thickness and work hardening on the surface transfer
- Investigation on the influence of rolling speed, work roll roughness, and lubrication on the surface transfer
- Numerical simulation of surface transfer on the basis of model (2D & 3D) and industrial EDT surfaces

Measured surface topography | discretization for 3D Finite Element Model and validation of 3D model [1]

Sub-Project 3: Micro-Macro Link & Forming
- Generating macro-mechanical input out of microstructure data by using a homogenization method regarding hardening, anisotropy, and forming limits
- FEM-simulation of forming

Cross die exp. superimposed with sim. | FLD of exp. (black) vs. sim. (colored) | comparison of different drawing depth

Sub-Project 4: Aging
- Laboratory processing and characterization of the material regarding various aging scenarios
- Development of a physically based model for precipitation evolution
- Development of a model for evolution of yield stress during hardening

TEM micrograph after artificial ageing (AA) | model flowchart | influence of pre-strained areas on final properties after AA [2]

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References: