

Aluminium Metallurgy, Processing and Application in automotive design

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Introduction to basic material science of Aluminium alloys and related technical topics of Aluminium alloys, fabrication, processing and applications (as castings, extrusions, sheet), e.g. in transport (or else). Specific Aluminium Alloys and properties for products in automobile applications, links to public information and e-learning tools

For engineers from Aluminium producing or applying companies (or interested there-in), students, lecturers with limited pre-knowledge! Easy to follow technical (interactive) presentations in English (well understandable by an experienced, non-native speaker),

1) Basic Metallurgy of Aluminium

1.1 **Introduction** History, physical properties, processing principles

1.2 **Structure of Aluminium**

- Atomic lattice structure, microstructure
- Texture : presentation and evaluation methods, origin and anisotropy effects
- Structural defects, microstructure and basic properties :
Solutions, diffusion, vacancies, dislocations, grain boundaries, precipitations

1.3 **Principal strengthening mechanisms in Aluminium alloys**

- Alloy- / solid solution hardening
- Plastic deformation & strain hardening
- Softening mechanisms, recovery and recrystallization
- Precipitation & age hardening

1.4 **Aluminium alloy designations and tempers**

1.5 **Thermodynamic effects of Aluminium production**

Phase diagram, Solidification, segregation effects, Homogenisation

1.6 **Internet Info and e-learning** (AluMatter, AluSelect, Al Automotive Manual)

1.7 Exercises to Topics in Basic Metallurgy of Aluminium

- *possible activities of the audience :*
- *AluMatter animated exercises (animated Hal-Petch evaluation, Texture presentation,)*
- *Voce-calculation for strain hardening/softening simulation*

2) Aluminium semi-fabrication (processing, microstructures, properties)

2.1 **Casting**

- Metal / lost Mould, Gravity-, Low/High pressure die Casting,

- DC casting, twin roll casting

2.2 **Extrusion**

- Aluminium Extrusion press configurations
- The Extrusion Process Chain
- Microstructure Evolution

2.3 **Rolling**

- Aluminium Rolling Mill Configurations
- The Rolling Process Chain
- Microstructure Evolution

2.4 **Through Process Modelling “TPM” (see exercise)**

2.5 **Input/questions from the auditorium**

3) **Aluminium Applications and Products in Transport & Automotive**

3.1 Aluminium Automobile Alloys, Parts & Design Studies and Examples

3.2 Body-in-white, chassis, hang-on-parts, structural parts, heat exchangers, tailored blanks & tubes, ,...

3.3 Innovative developments, multi-material SLC “Super-Light-Car design, material competition & comparisons

3.4 Actual examples of Aluminium intensive car design (AUDI, Ford, Jaguar/LR, ...)

3.5 Other issues (audience - please indicate in advance)