

AluMag Roadshow

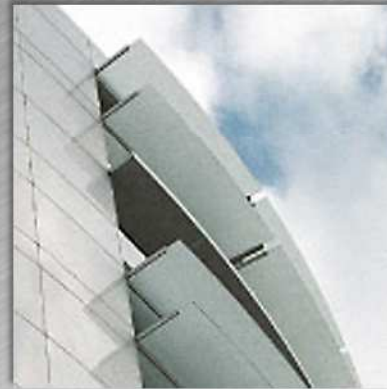
Dirk van Nieuweburgh
19. - 21. March 2013



Agenda



- Aleris company overview
- Portfolio 6xxx qualities
- Supply references 6xxx qualities
- Automotive grades 5xxx
- Aleris Product development
- R & D set up



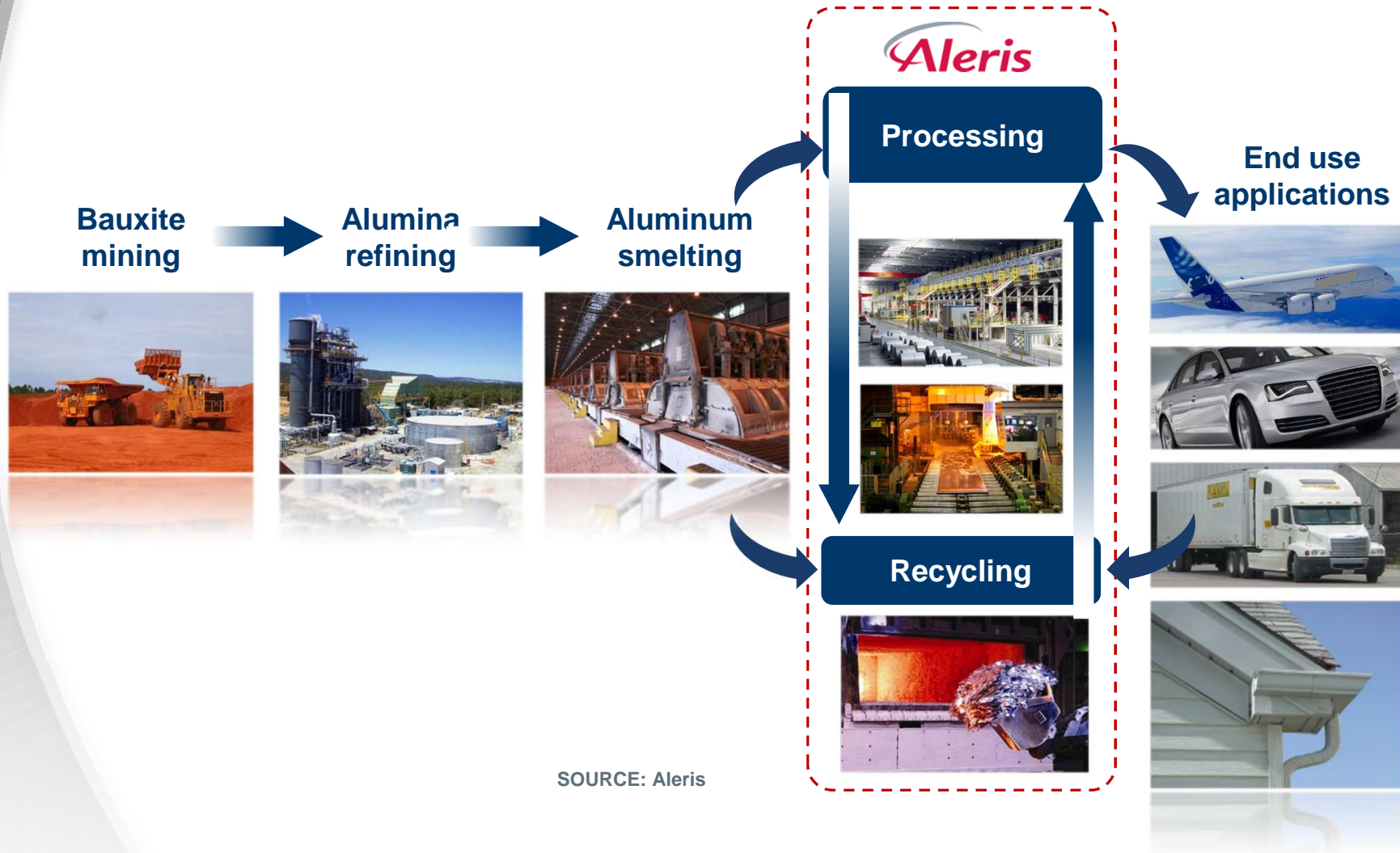
ALERIS AT A GLANCE



- Aleris is a global leader in aluminum rolled and extruded products, recycled aluminum, and specifications alloy manufacturing
- Global headquarters in Beachwood, Ohio a suburb of Cleveland (USA)
- 2012 sales: USD 4.5 billion
- Approx. 7,300 employees in 17 countries
- 43 strategic, flexible and technologically advanced production facilities in North America, Europe and Asia

Aleris, a global leader in aluminum fabrication and recycling

Aleris in the global aluminum value chain



SOURCE: Aleris

Aleris participates in select segments of aluminum fabricated products industry

Aleris market and customer portfolio



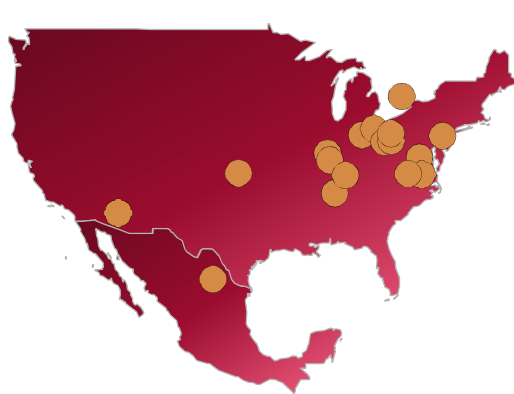
AEROSPACE & DEFENSE	AUTOMOTIVE & HEX	DISTRIBUTION	BUILDING & CONSTRUCTION	COMMERCIAL TRANSPORT.	RECYCLING
 AIRBUS	 Audi	 RYERSON THE STRENGTH IN METAL	 Ply GEM BUILDING PRODUCTS. BUILDING SUCCESS.	 <i>Great Dane Trailers</i>	 ALCOA
 BOEING	 GM	 Reliance Steel & Aluminum Co.	 Euramax	 SIEMENS	 Rio Tinto Alcan
 BOMBARDIER	 Mercedes-Benz	 ThyssenKrupp	 Rollex	 FFB	 ADITYA BIRLA NOVELIS
 EMBRAER	 Ford				 HYDRO
 COMAC	 DENSO				
	 MODINE				
	 BEHR				

Aleris, a partner to top industry leaders

Aleris global geographic footprint



North America



Europe



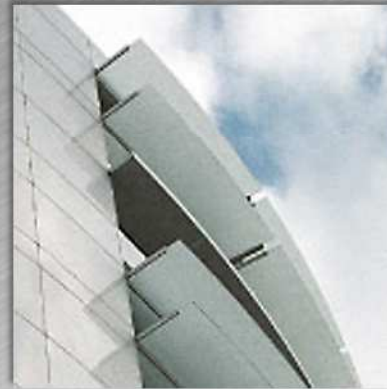
China



Key facilities

- **Koblenz**
 - World class capabilities
 - New 160" mill, strongest in world
- **Duffel**
 - New/refurbished Koblenz hot mill
 - New wide cold rolling mill
 - Widest CALP line
- **Lewisport**
 - Launching pad for N.A. auto growth
- **Uhrichsville/Richmond**
 - Lowest cost/scrap based
- **Recycling**
 - Multiple locations supply molten
 - Morgantown – milling operations
- **Extrusions**
 - Bonn - one of the largest presses in EU
 - Tianjin - doubling capacity

Aleris, a global leader in aluminum fabrication and recycling



PORTFOLIO 6xxx QUALITIES



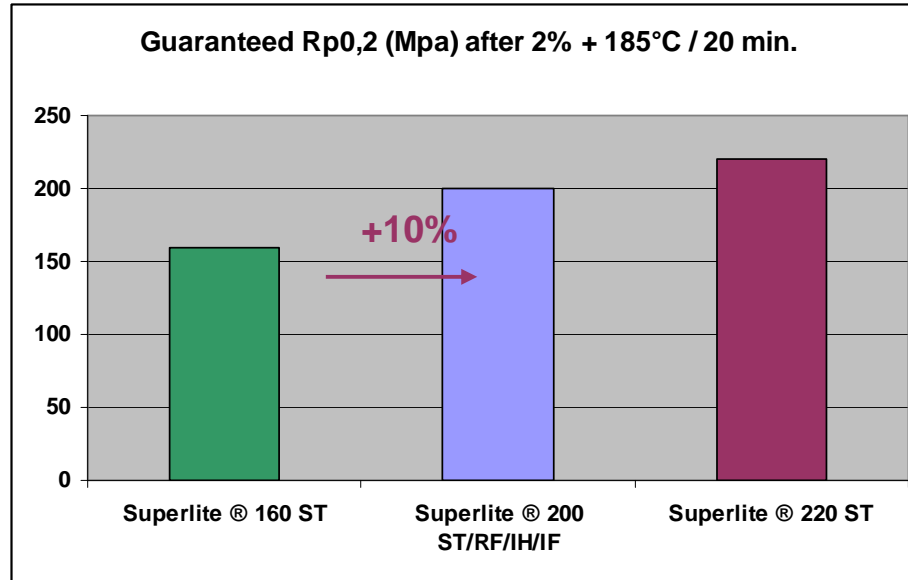
EN 6016 Monosheet Uni-alloy portfolio



Outer Panels		
Superlite [®] 160 ST	Standard	EN6016
Superlite [®] 200 ST	Standard	EN6016
Superlite [®] 200 RF	Roping Free	EN6016
Superlite [®] 200 IH	Improved Hemming	EN6016
Superlite [®] 200 IF	Improved Forming	EN6016
Superlite [®] 220 ST	Standard	EN6016
Inner panels & Structural Parts		
Ecolite [™] 160 ST	Standard	EN6016
Ecolite [™] 160 RO	Roping Optimised	EN6016
Ecolite [™] 210 ST	Standard	EN6016
Ecolite [™] 210 RO	Roping Optimised	EN6016
Ecolite [™] 250 ST	Standard	EN6016

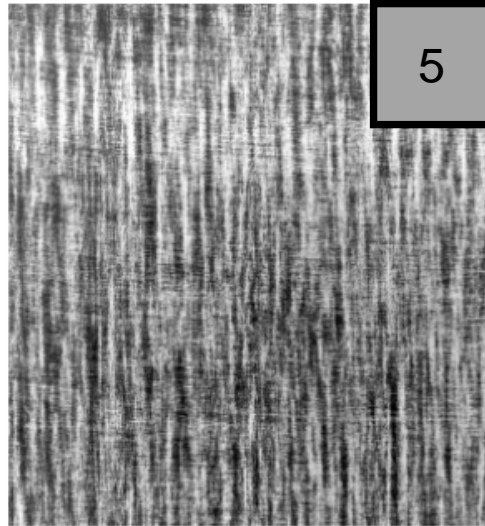
	Strength	Hemming	Roping	Formability
Outer panels				
Superlite [®] 160 ST	+	+++	++	+++
Superlite [®] 200 ST	++	++	++	++
Superlite [®] 200 RF	++	++	++++	++
Superlite [®] 200 IH	++	+++	++	++
Superlite [®] 200 IF	++	++	++	+++
Superlite [®] 220 ST	+++	++	++	+
Inner panels & Structural Parts				
Ecolite [™] 160 ST	+	++	-	++
Ecolite [™] 160 RO	+	++	+	++
Ecolite [™] 210 ST	++	++	-	++
Ecolite [™] 210 RO	++	++	+	++
Ecolite [™] 250 ST	++++	+	-	+

All "EN 6016"

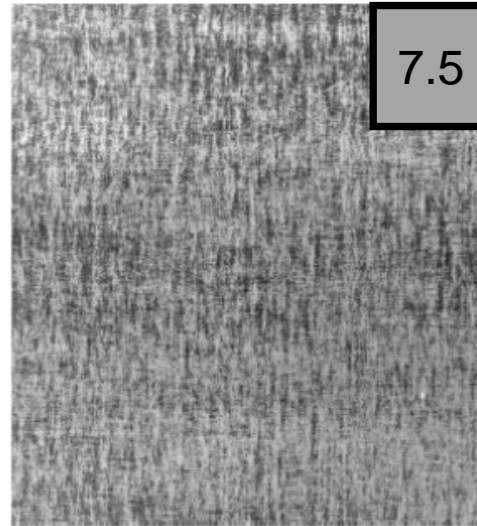


		Superlite®					
		160 ST	200 ST	200 RF	200 IH	200 IF	220 ST
T4 As delivered	Rm (Mpa)	200-240	200-250	200-250	200-250	200-250	220-270
	Rp0,2 (Mpa)	90-120	90-130	90-130	90-130	90-130	110-150
	Au (%)	min.20	min.20	min.20	min.20	min.22	min.20
	A80 (%)	min.24	min.24	min.24	min.24	min.26	min.23
	n 5%	min.0,28	min.0,27	min.0,27	min.0,27	min.0,28	min.0,27
	delta r 10%	max.0,30	max.0,33	max.0,20	max.0,33	max.0,20	max.0,30
after 2% + 185°C/20min	Rp0,2 (Mpa)	min.160	min.200	min.200	min.200	min.200	min.220

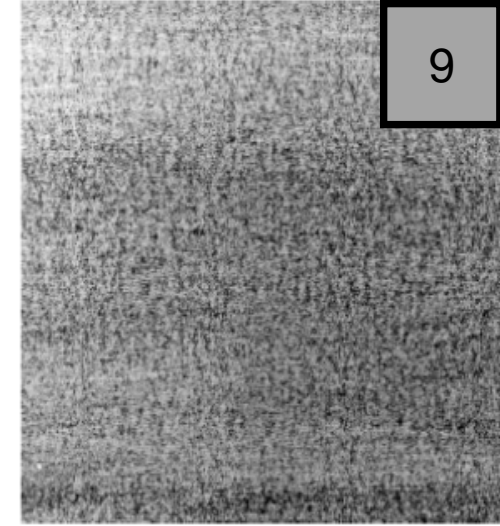
Outer Panels = Superlite®



Ecolite 160/210/250



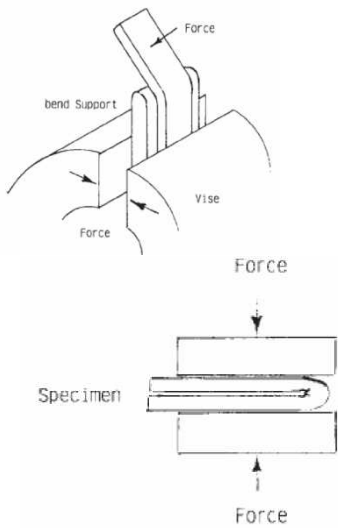
Superlite 200 ST/IH



Superlite 200 RF

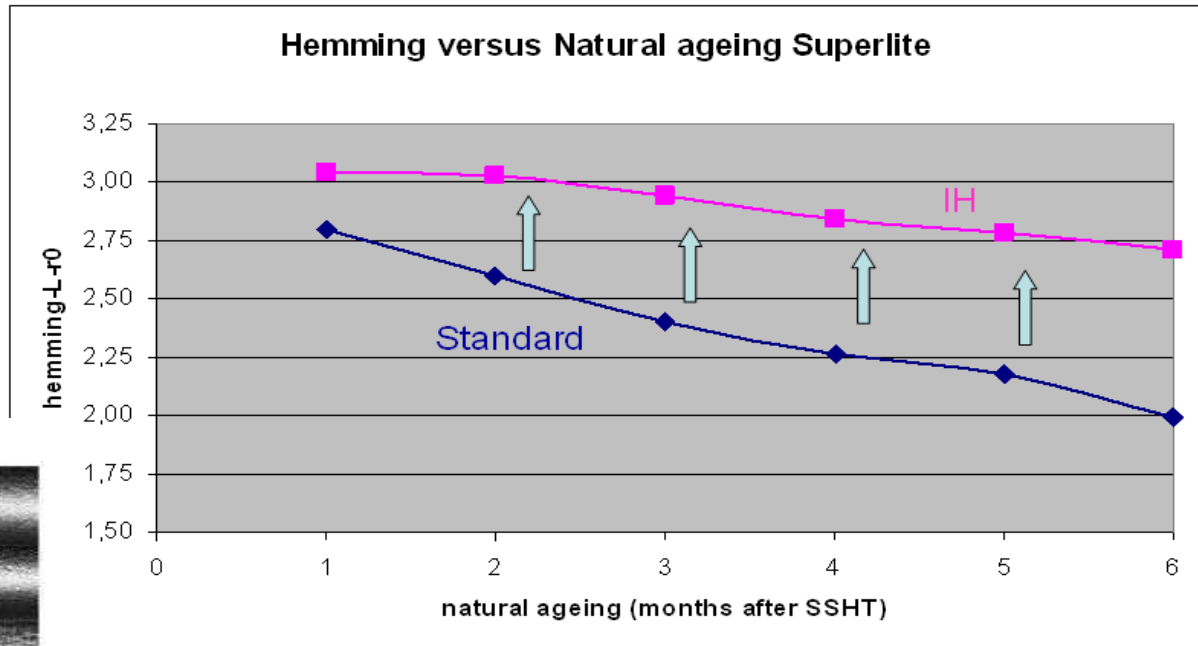
- Sample 100 x 300 mm 15% stretched perpendicular to rolling direction
- Slightly grinded with P800 sandpaper
- Visual inspection and rating 1-10

Superlite® 200 RF for panels heavily stretched \perp to rolling direction



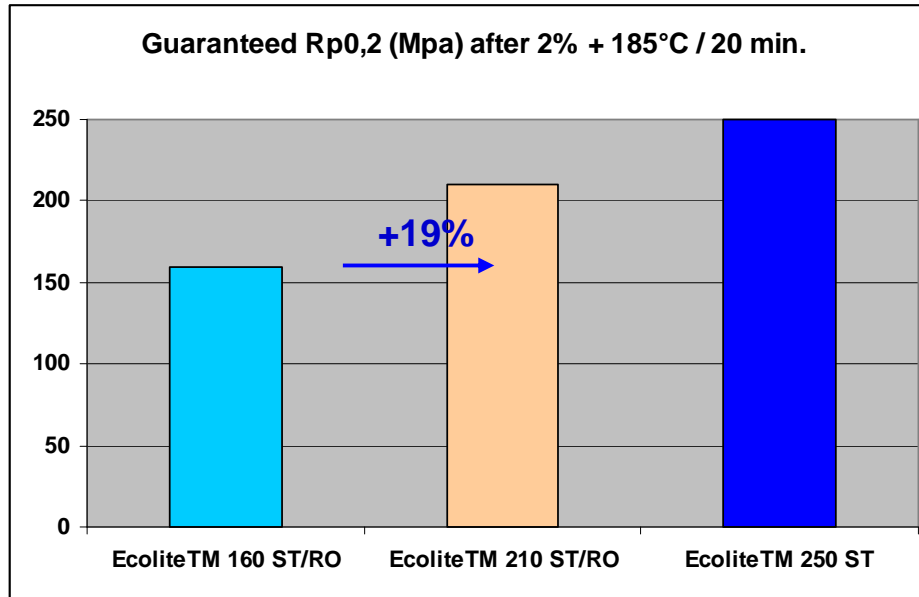
Legend:

- 5 No visual defect
 - 4 Mild surface roughening
 - 3 Severe surface roughening
 - 2 Small surface cracks
 - 1 Continuous surface crack
-



Superlite® 200 IH for Hemming critical panels

Ecolite™ Material Data



		Ecolite™		
		160 ST/RO	210 ST/RO	250 ST
T4 As delivered	Rm (Mpa)	200-250	200-250	min.240
	Rp0,2 (Mpa)	100-140	100-140	120-160
	Au (%)	min.20	min.20	min.20
	A80 (%)	min.23	min.23	min.23
	n 5%	min.0,27	min.0,27	min.0,27
	delta r 10%	max.0,40	max.0,40	max.0,40
after 2 % + 185°C/20 min	Rp0,2 (Mpa)	min.160	min.210	min.250

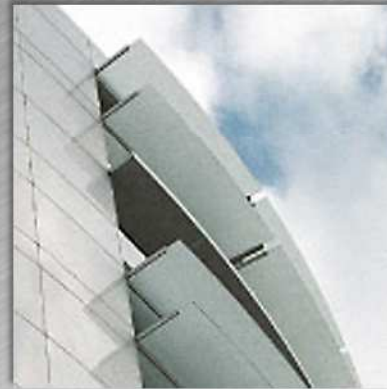
Inner panels = Ecolite™

“EN 6016” Monosheet Uni-alloy portfolio



	Strength	Hemming	Roping	Formability
Outer panels				
Superlite [®] 160 ST	+	+++	++	+++
Superlite [®] 200 ST	++	++	++	++
Superlite [®] 200 RF	++	++	++++	++
Superlite [®] 200 IH	++	+++	++	++
Superlite [®] 200 IF	++	++	++	+++
Superlite [®] 220 ST	+++	++	++	+
Inner panels & Structural Parts				
Ecolite [™] 160 ST	+	++	-	++
Ecolite [™] 160 RO	+	++	+	++
Ecolite [™] 210 ST	++	++	-	++
Ecolite [™] 210 RO	++	++	+	++
Ecolite [™] 250 ST	++++	+	-	+

A suitable EN 6016 grade for every panel !



AUTOMOTIVE GRADE 5xxx

Aleris

Aleris Automotive Grades 5xxx

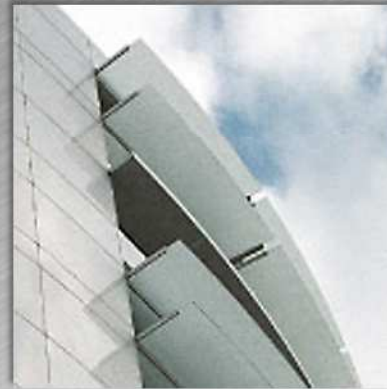


Typical mechanical values in delivery condition:

EN	Product	Mg content	Rp0,2	Rm	A80	n5%
5051A	Aleris 521	1,9	90	185	22	
5754	Aleris 832	2,7	110	215	22,5	0,27
5754	Aleris 532	3,3	90	215	26	0,29
5754	Aleris 835	3,2	120	230	24	0,29
5182	Aleris 843	4,3	135	270	26	0,30
5182	Innerlite [®]	4,9	125	275	27	0,32

Innerlite[®] : Formability optimised 5182





ALERIS PRODUCT DEVELOPMENTS



Drivers BIW OEM



Design / Quality
Crash absorption
Sustainability

- Lightweight
- Sustainable materials
- Recycling potential

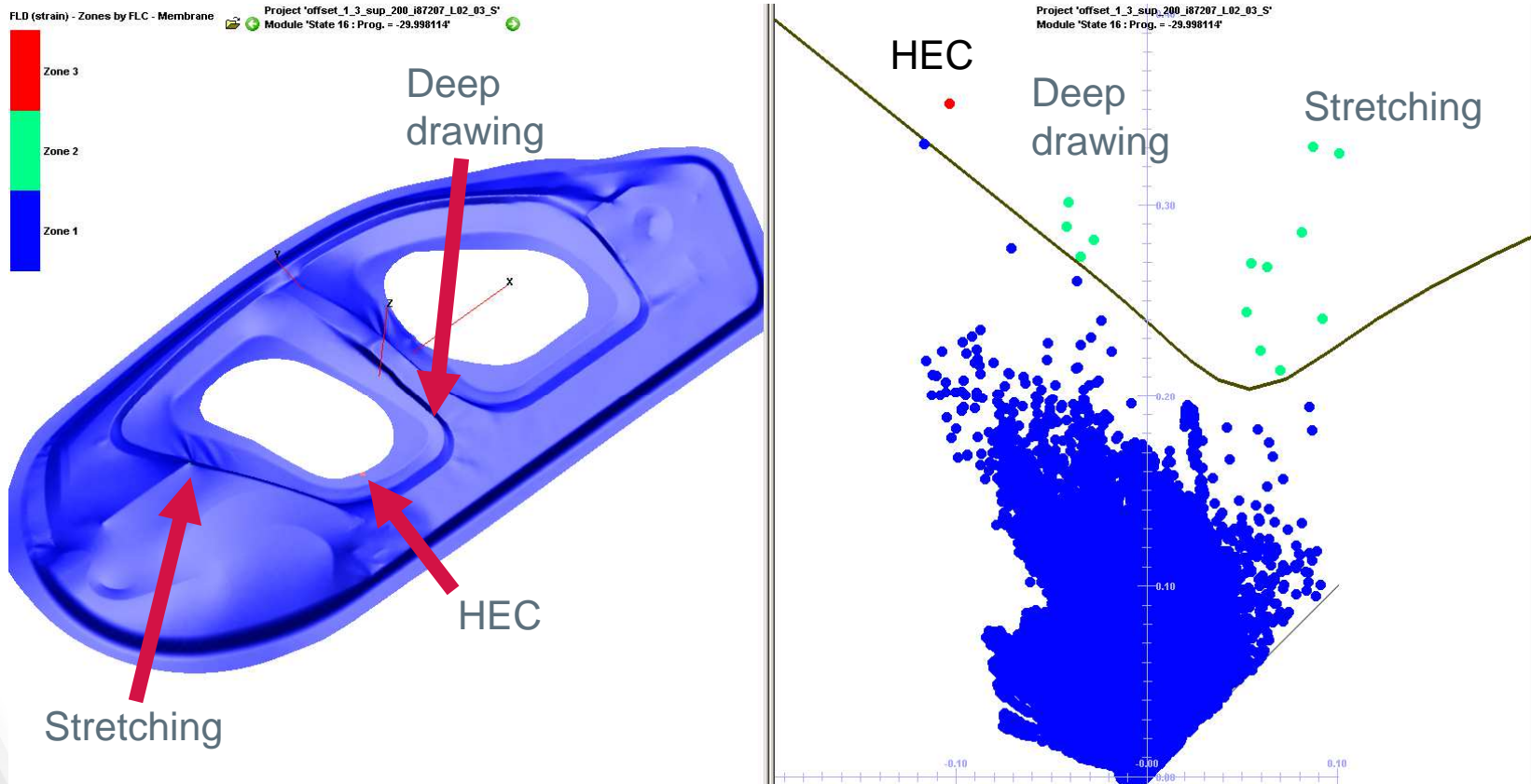
Cost efficiency
Global manufacturing

Derived targets for materials



- Better formability for inner and outer panels
 - High surface quality materials for outer panels
 - Crash / Pedestrian safety
 - Recycling alloys / EOL-materials
 - High strength materials : 6xxx & 7xxx
 - Cost efficient production
 - Global availability
- 6xxx developments**
- Red arrows point from the text '6xxx developments' to the following list items: 'High surface quality materials for outer panels', 'Crash / Pedestrian safety', 'Recycling alloys / EOL-materials', and 'High strength materials : 6xxx & 7xxx'.

Failure in a complex product



All three modes are present => product with optimum formability characteristics difficult to develop

High formability

Superlite® 180 + 200 ID

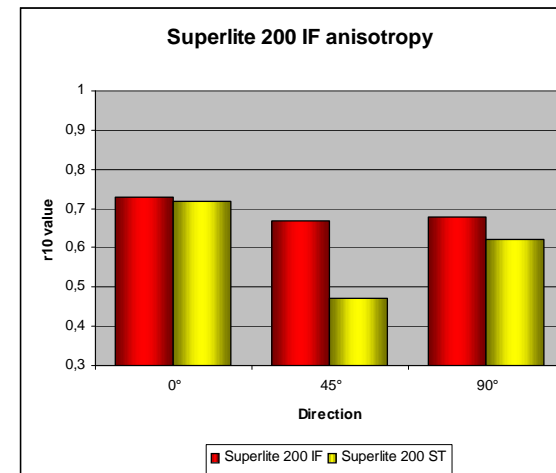
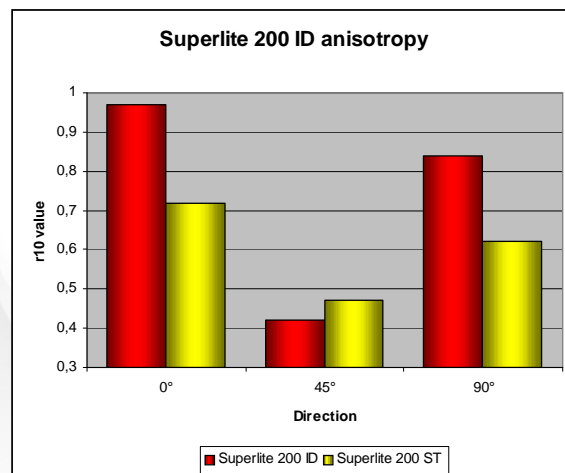
- High formable 6016 material specifically suited for deep drawing and hole expansion forming
- Main characteristics (typical values in delivery condition) :

Rm (MPa)	220	LT
Rp0,2 (MPa)	110	LT
A80 (%)	27	LT
A unif. (%)	22	LT
n 5%	0,30	LT
r 10%	0,84	LT
r 10%	0,42	45°
r 10%	0,97	L
Δr	0,50	

Superlite® 200 IF

- High formable 6016 material specifically suited for stretch forming
- Main characteristics (typical values in delivery condition) :

Rm (MPa)	220	LT
Rp0,2 (MPa)	110	LT
A80 (%)	27	LT
A unif. (%)	23	LT
n 5%	0,29	LT
r 10%	0,68	LT
r 10%	0,67	45°
r 10%	0,73	L
Δr 10%	0,02	



High surface quality materials



- Higher surface demands due to more deformed panels
- Surface quality improvement for outer panels based on optimization of thermomechanical processing, taking into account cost
- Roping : combination of width & length of lines and contrast

- | | | | |
|-------------------|---|-----------------------|---------|
| Superlite® 200 ST | - | Further optimizations | -200 RF |
|-------------------|---|-----------------------|---------|



Crash resistant qualities

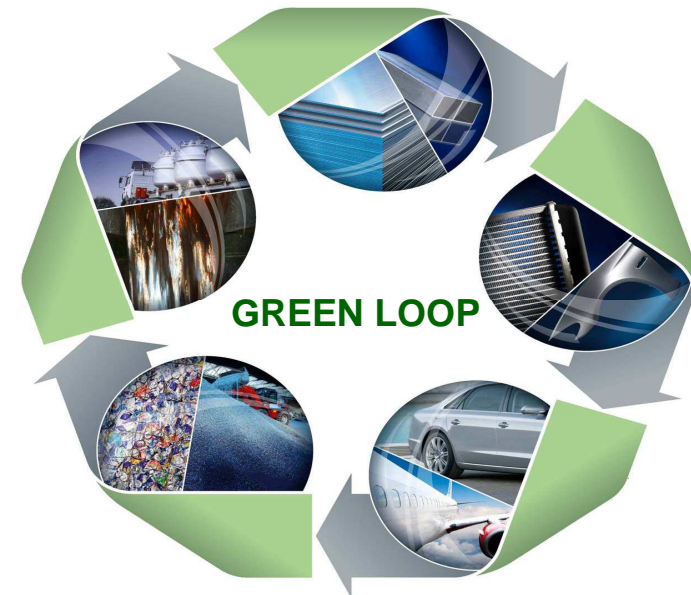
- Several products developed / under development in line with different specifications from customers
- Balance of strength and crash performance
- Products :
 - Ecolite 190 C
 - Ecolite 210 C
 - Ecolite 230 C T61
 - Ecolite 230 C T4



Sustainable materials



- Increase recycled content in automotive products while maintaining as high as possible “normal” properties
- Recycled content : no final definition yet
 - Production scrap from rolling plants
 - Customer production process scrap
 - EOL scrap
- Closed loop recycling concepts contributing to higher recycled content
- Ecolite™ Green/Blue : material concepts in development for 6xxx recycling qualities (based on Ecolite™ products), differentiated by guaranteed amount of recycled content (Blue without guarantee for EOL scrap, Green with guarantee for EOL scrap)



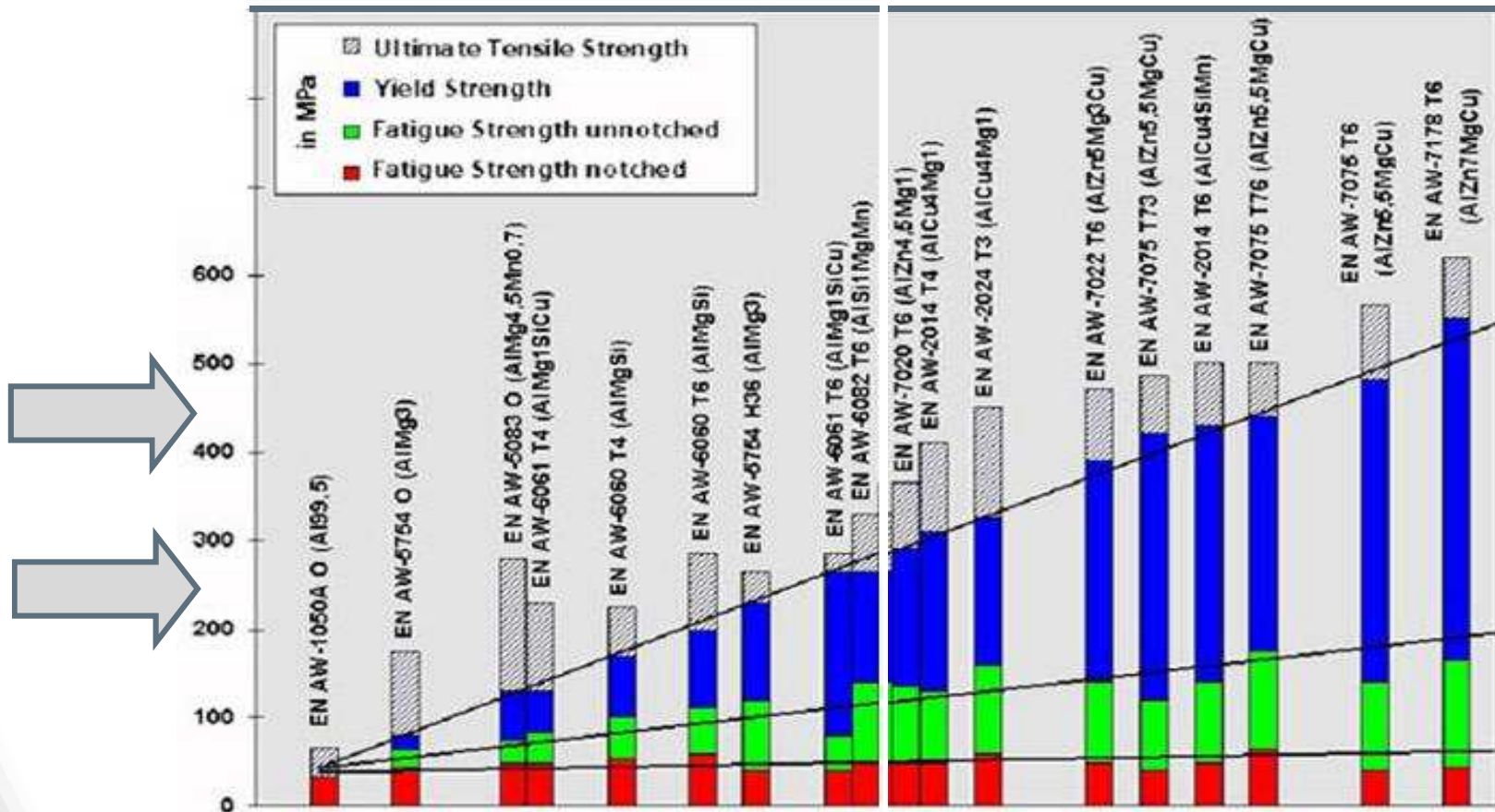
Sustainable materials - Ecolite™ Green example



- Composition within 6016 and within OEM Spec
- Mechanical properties :
 - T4 : Re 121 MPa
 - Rm 245 MPa
 - A80 26%
 - r 0,69
 - n 0,30
 - T6 (2% + 185°C 20') :
 - Re 249 MPa
 - Rm 310 MPa
 - A80 19%
 - higher strength in T4 and T6 compared to Ecolite™ 210 ST

5xxx / 6xxx alloys

7xxx alloys



High Strength Aluminium Alloys Aleris Heritage



Maximum Strength $R_{p0.2} \approx 250\text{MPa}$



Maximum Strength $R_{p0.2} \approx 600\text{MPa}$

Mature 7xxx alloy technology supplied to a
safety critical industry



Development approach for Automotive Structural Parts :

Medium strength Al-Zn-Mg system : **Structurlite™400**

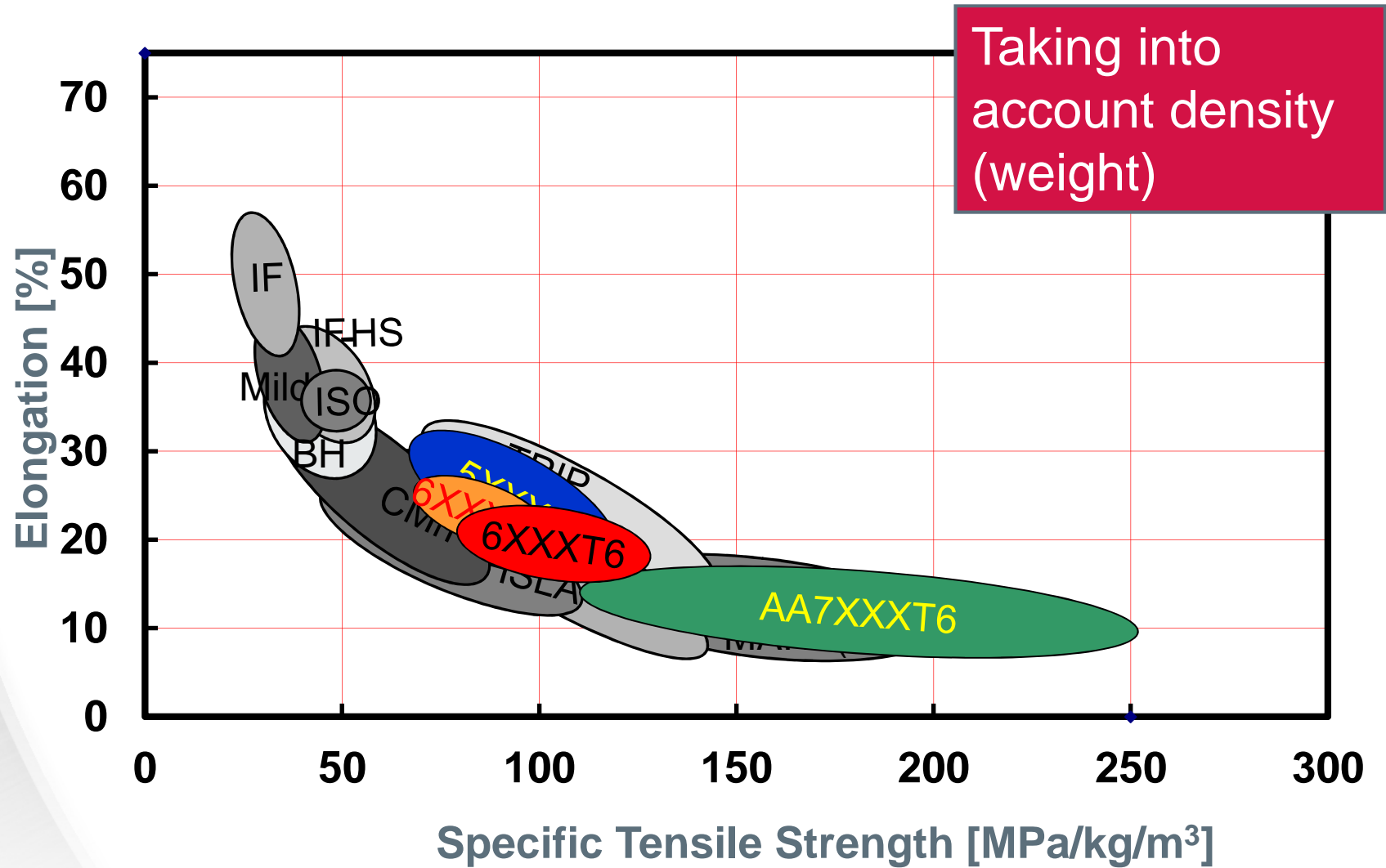
High strength Al-Zn-Mg-Cu system : **Structurlite™5xx**

Structurlite™ 400 : $R_{p0.2}$ 400 MPa

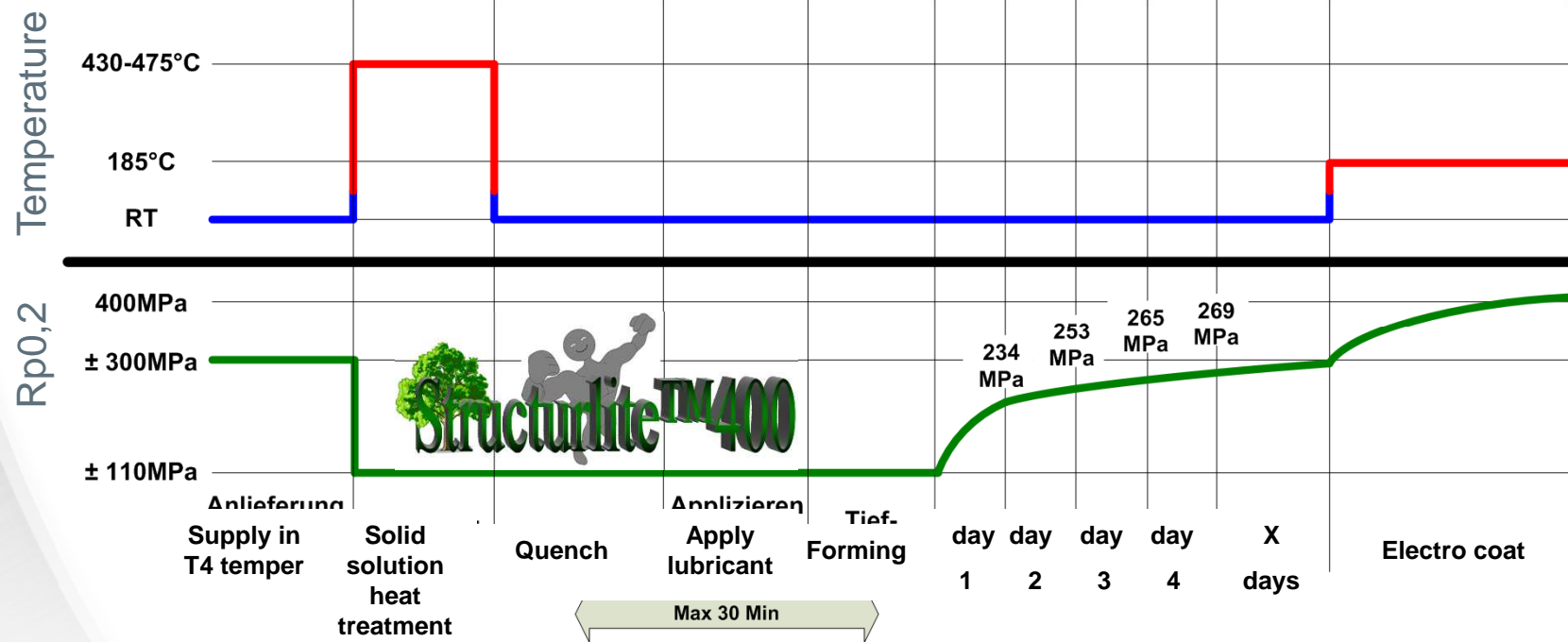
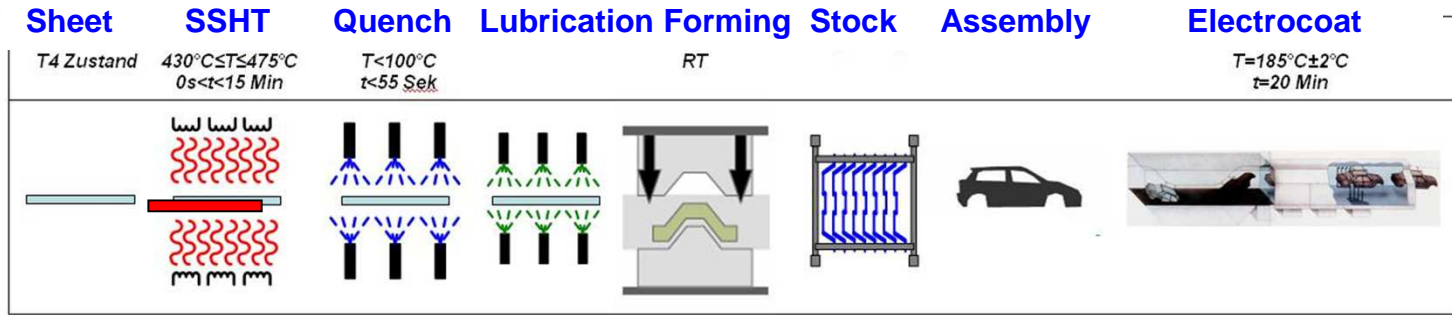
Structurlite™ 5xx : $R_{p0.2}$ 500 - 590 MPa

High strength materials

High Strength 7xxx Aluminium Alloys



High strength materials 7xxx W-temper forming



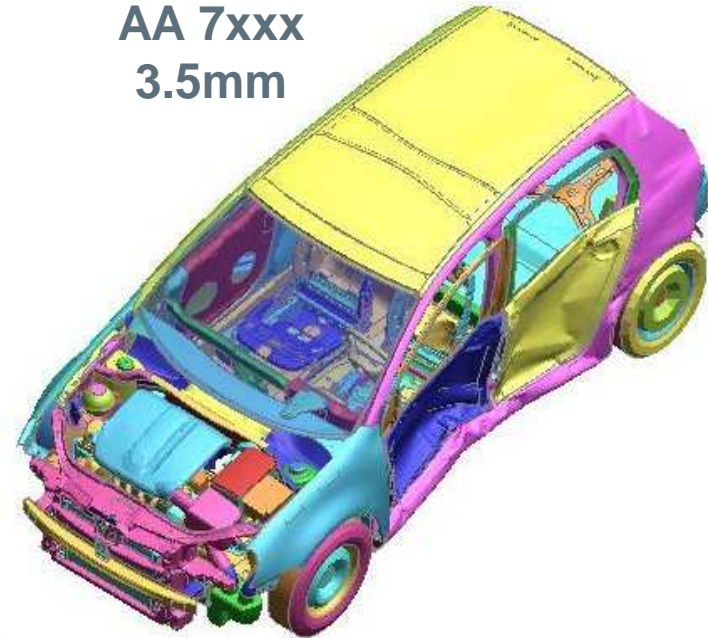
Developments 7xxx Comparison with UHS steel



Boron steel
2mm



AA 7xxx
3.5mm



SLC

The crash performance
is very similar in all
results

Mass saving with
aluminium component
is 40%

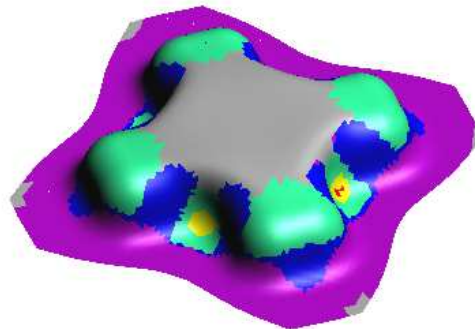
Developments 7xxx Structurlite™ 400 Formability



Forming in T6



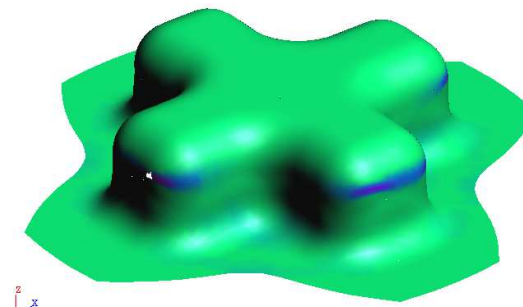
Press trial = 27.5mm
Simulation = 27mm



Forming after Flash Anneal

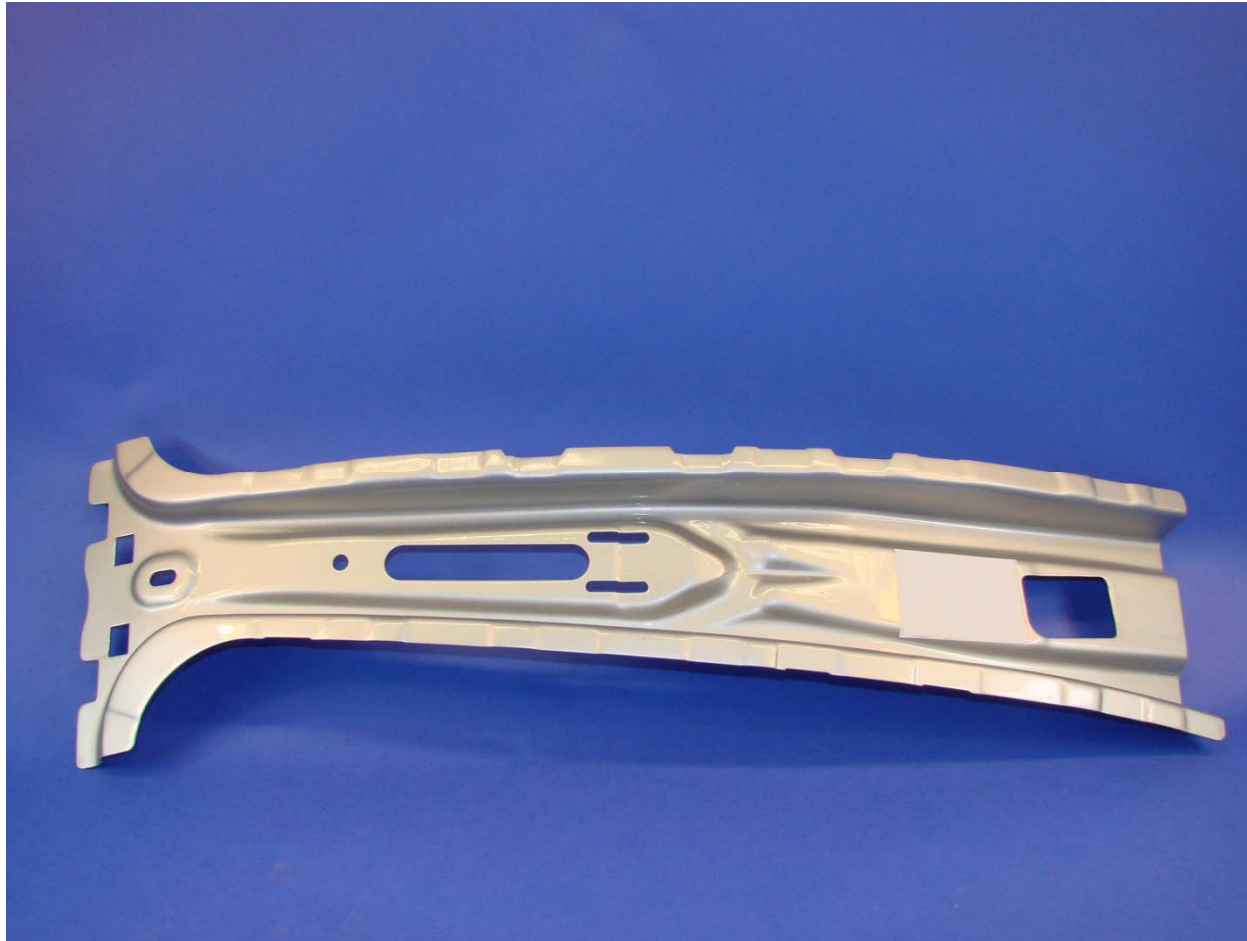


Press trial = 58mm
Simulation = 57mm

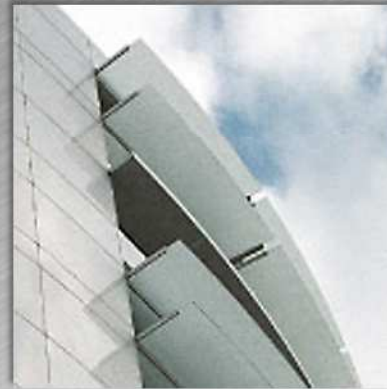


Flash anneal provides excellent formability

Developments 7xxx Structurlite™ 400 Formability



Flash anneal provides excellent formability



R & D SET UP

Aleris

Steering

- Aleris Management
- PMTs



Aleris Innovation Centers

Koblenz

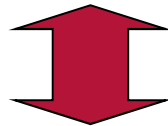
- Aerospace
- Heat Exchanger
- Plate & Defence

Duffel

- Automotive
- Coil & Sheet
- Extrusions

Aachen (central lab)

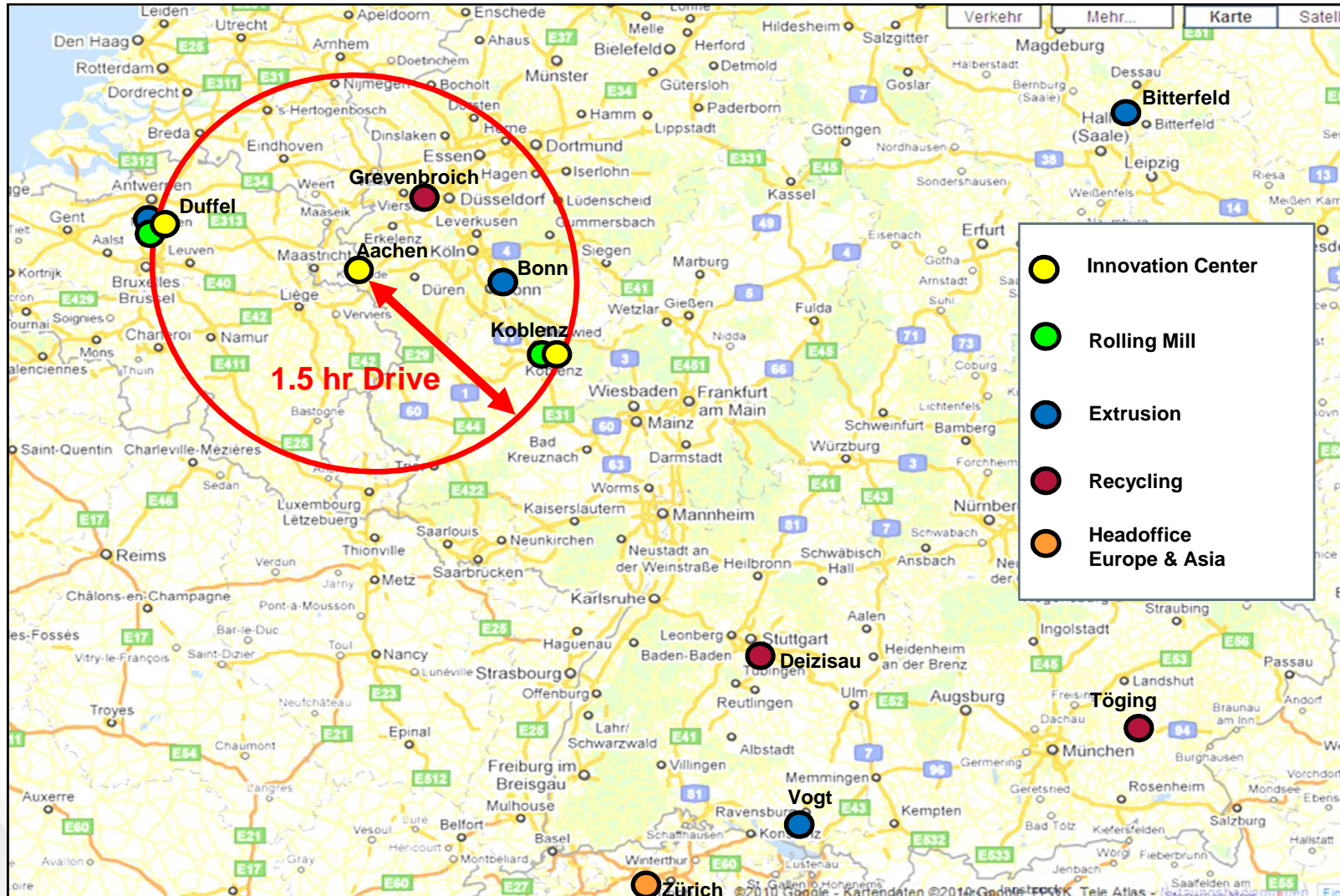
- Alloy development and scrap technology
- Casting / rolling / extrusion
- Modelling / design simulations

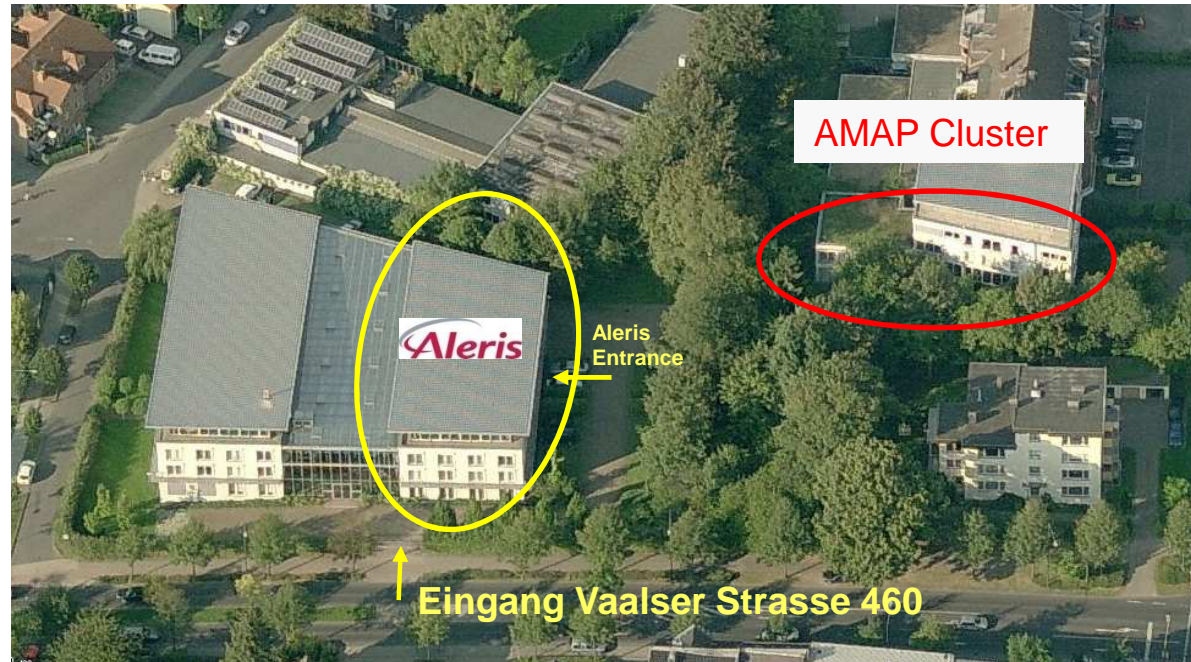


External collaborations

- Universities
- Independent research centers
- Customers

Innovation Center Aachen





Q & A
???

Thank you for your attention