



## **Rolling Plant Technology for Can Stock and Aluminium Body Sheet**

Ralf Ohrndorf, SMS group

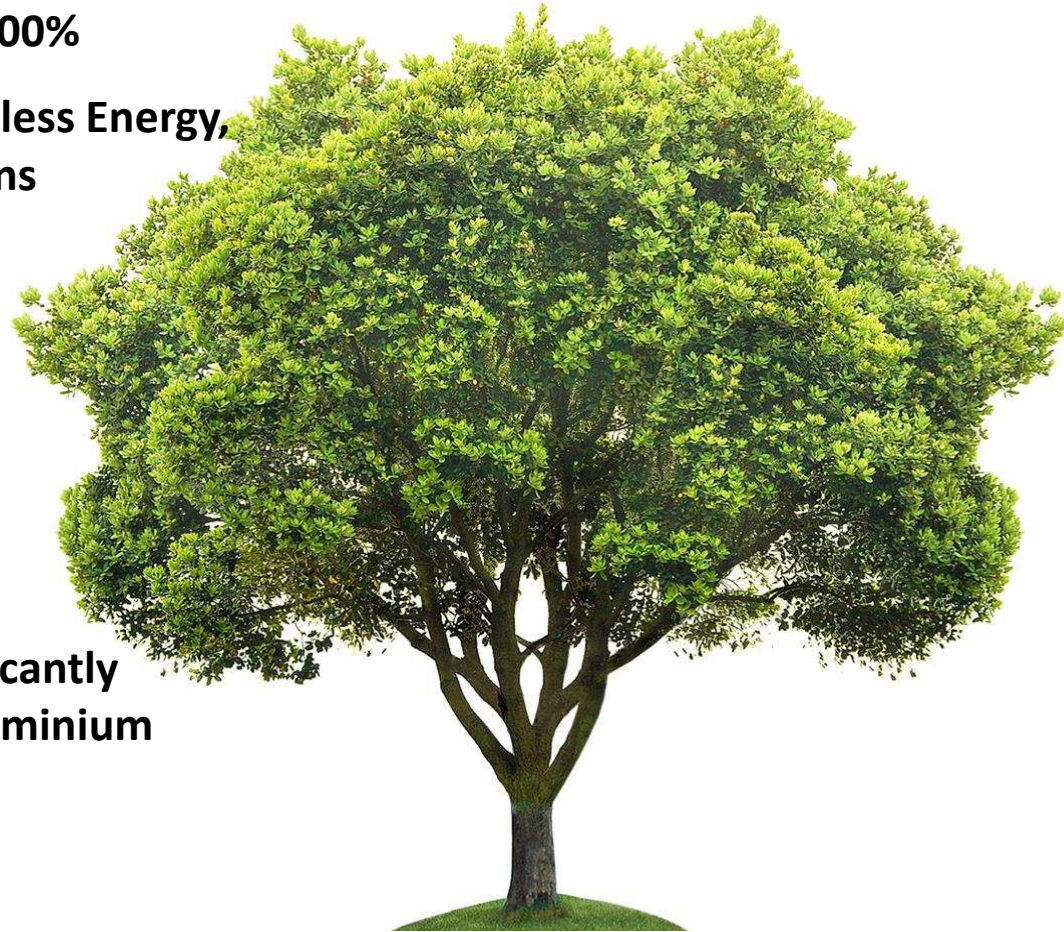
Iran International Aluminium Conference IIAC2016, Teheran



In 2012, around 300 bn cans were manufactured globally and the market is growing about 3% annually. Global beverage can consumption has been grown with GDP over time, and it is expected to follow similar trajectory in the future. Rexam, beverage can producer, 2013

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- **High Recycling Rates**
- **High Recyclability – up to 100%**
- **Recycled Cans require 95% less Energy, less Emissions and Pollutions than Cans produced from Primary Aluminium**
- **Can Weight declined significantly – more Cans out of less Aluminium**
- **Better Shipping Efficiency**



**QUALITY**

BARRIER AGAINST AIR  
LIGHT and MOISTURE

**EFFICIENCY**

LIGHTWEIGHT  
STRONG

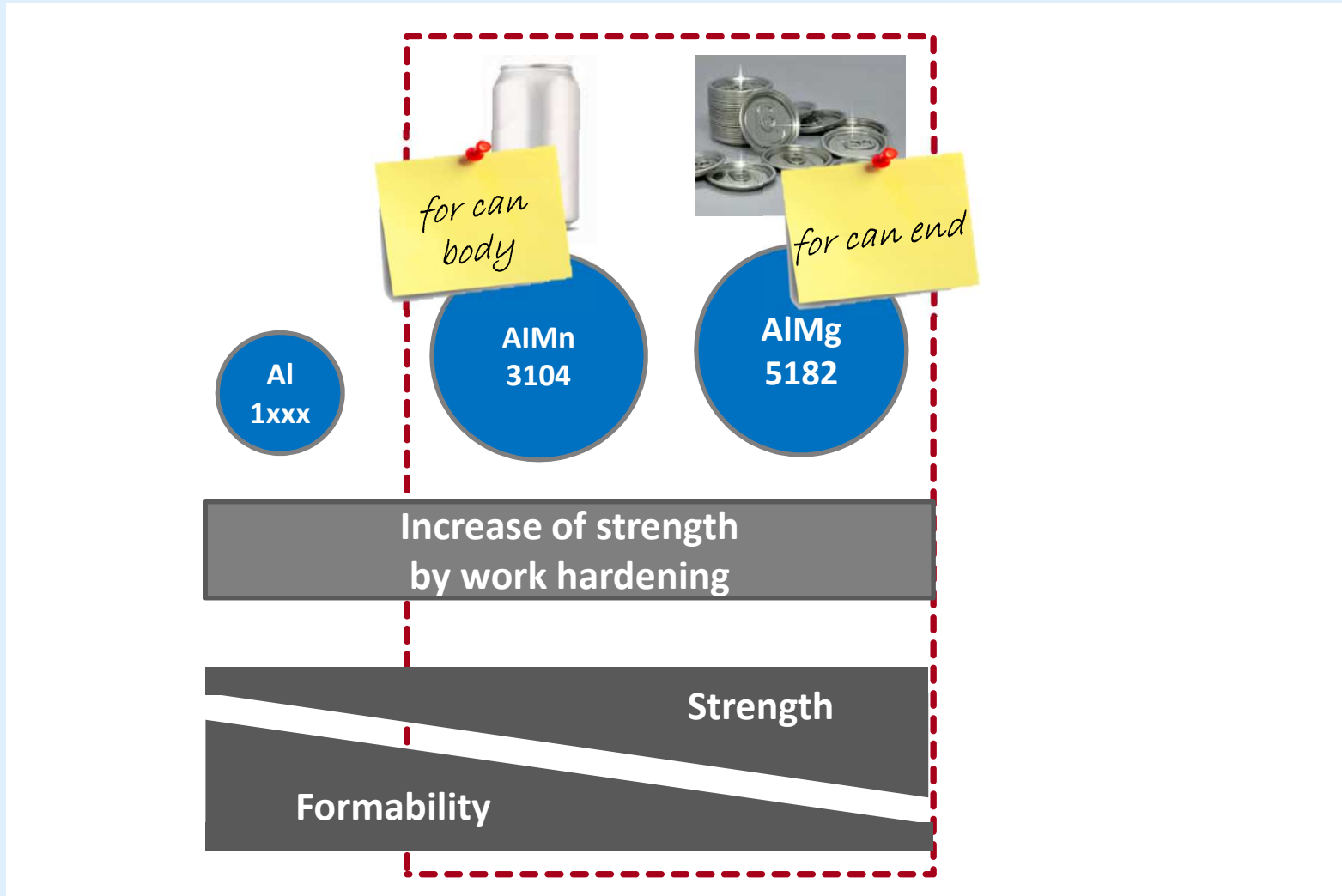


**SUSTAINABILITY**

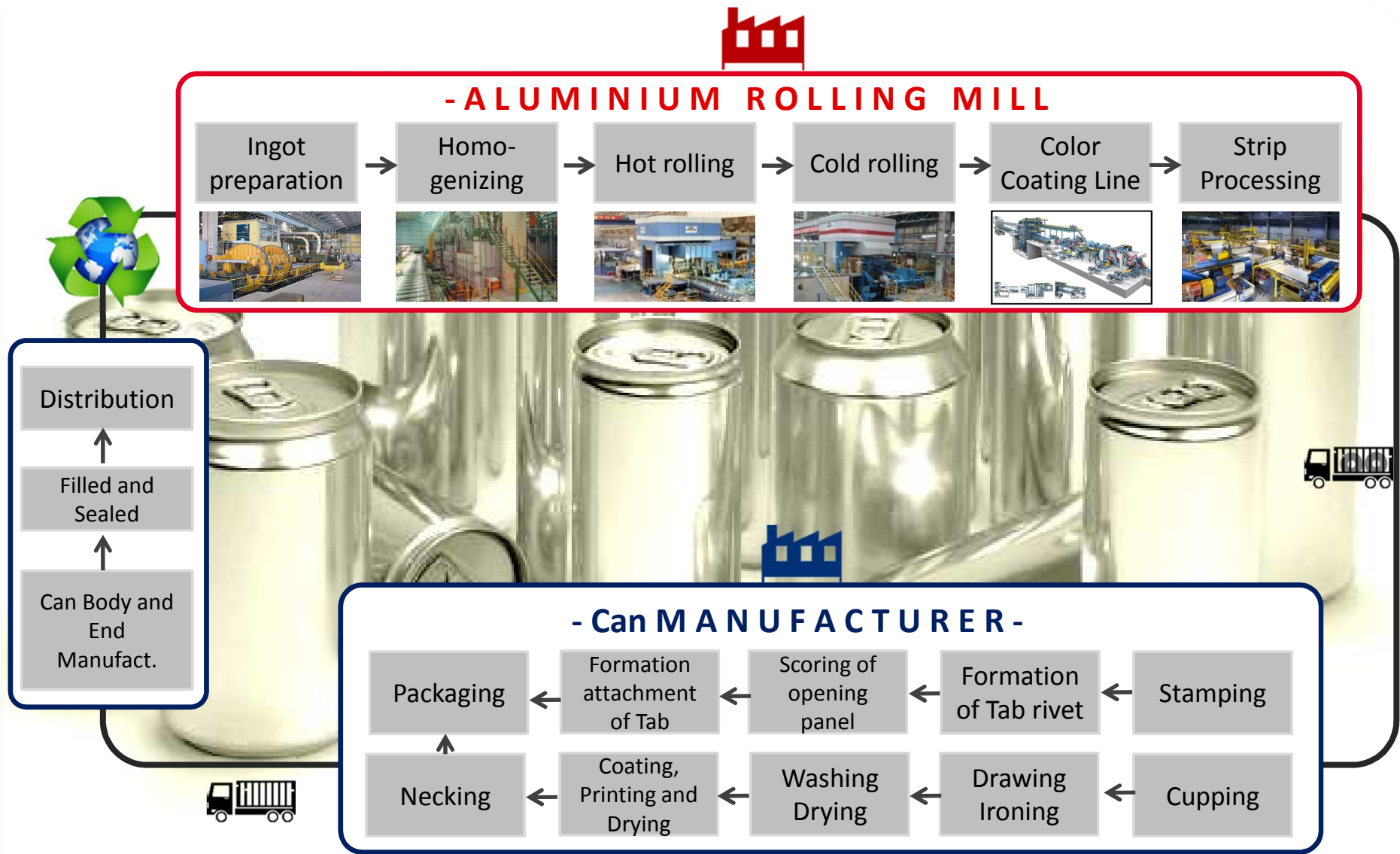
UNLIMITED RECYCLING  
LOW PRODUCTION ENERGY

**DESIGN**

FORMABILITY  
SHAPE and SURFACE



# SMS group Life cycle of an aluminium beverage can



### Minimizing of „Earing“ for Can Body Material



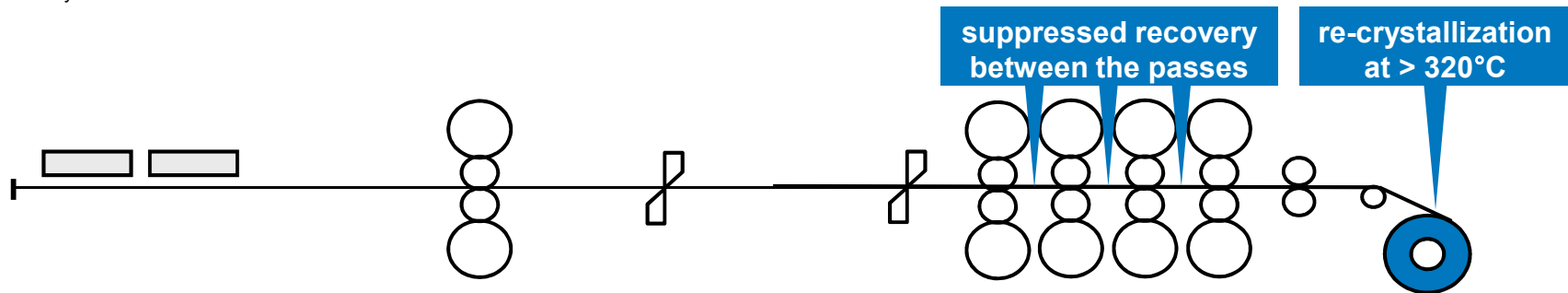
High „Earing“ ( $> 2\%$ ) due to anisotropic texture which is a combination of rolling texture and re-crystallization textures.



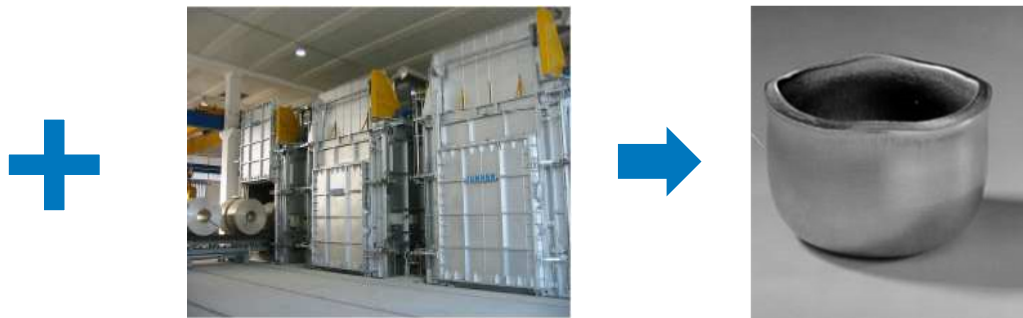
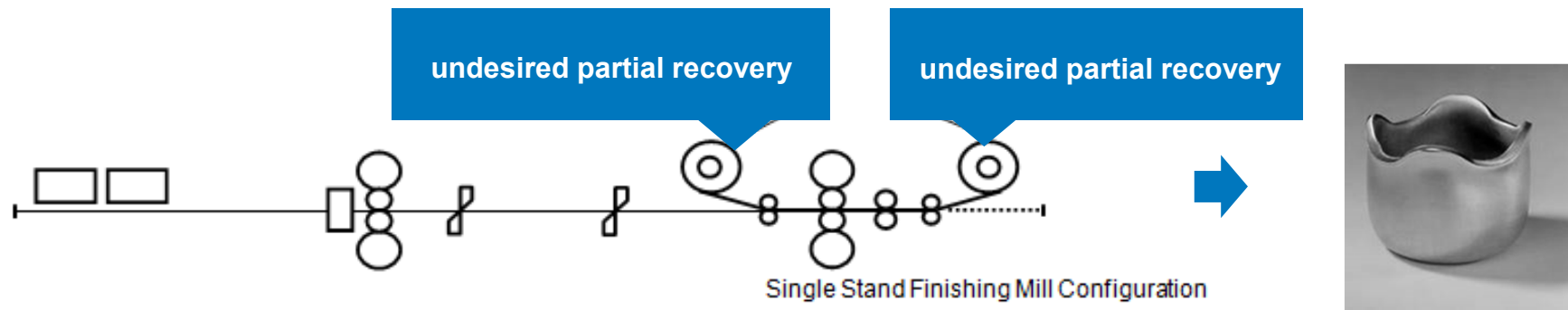
Reduced „Earing“ ( $\leq 1\%$ ) due to optimized rolling process:

- Suppression of inter-pass material recovery or re-crystallization during each finishing pass due to continuous rolling.
- Re-crystallization („Self annealing“) due to high coiling temperature.

Fotos: Hydro



### Minimizing of „Earing“ for Can Body Material



**The reversing hot rolling process requires an additional annealing process in order to perform the required re-crystallization of the material**

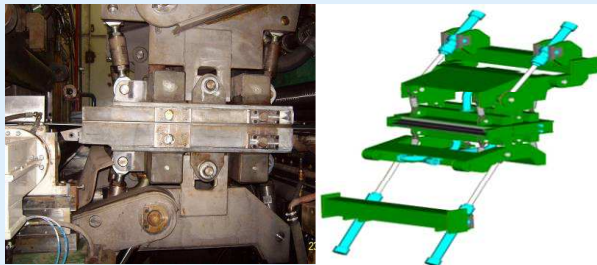


## Cold Rolling Mills for the Production of Can Stock Material



- Single Stand, 2-Stand, 3-Stand or 4-Stand Tandem Cold Rolling Mills
- Reductions > 90%;  
Temper H19 (extrem hard)

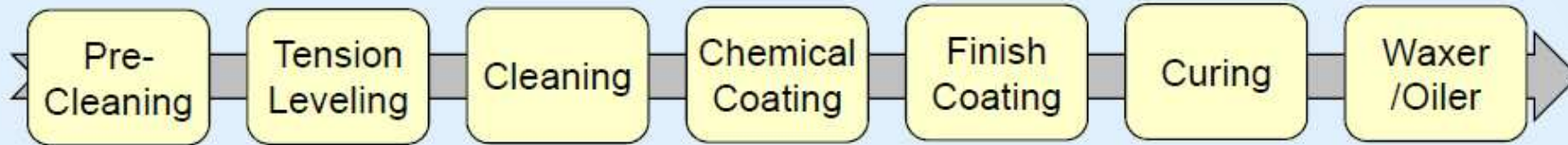
Especially for Multistand Tandem Mills using rolling oil als coolant a new developed „High Efficiency Cooling“ is required in order to keep the strip temperature in a required range



Closed Cooling: Rolling Process



Open Cooling. Threading Process



Coating	Material	Typical thickness
Waxing	Wax	8 $\mu\text{m}$
Coating outside	PES, PU, HDP, Epoxides	10 – 12 $\mu\text{m}$
Pre-Treatment	Cr <sup>3+</sup> , Ti/Zr	0.2 – 2.0 $\mu\text{m}$
Substrate	Aluminum	0.15 – 0.5 mm
Pre-Treatment	Cr <sup>3+</sup> , Ti/Zr	0.2 – 2.0 $\mu\text{m}$
Coating inside	PES, PU, HDP, Epoxides	4 – 8 $\mu\text{m}$
Waxing	Wax	8 $\mu\text{m}$



**“Use of Aluminium in automotive vehicles is growing at more than 25% a year”**

Marco Palmieri, Senior VP and President, Novelis North America (2013)

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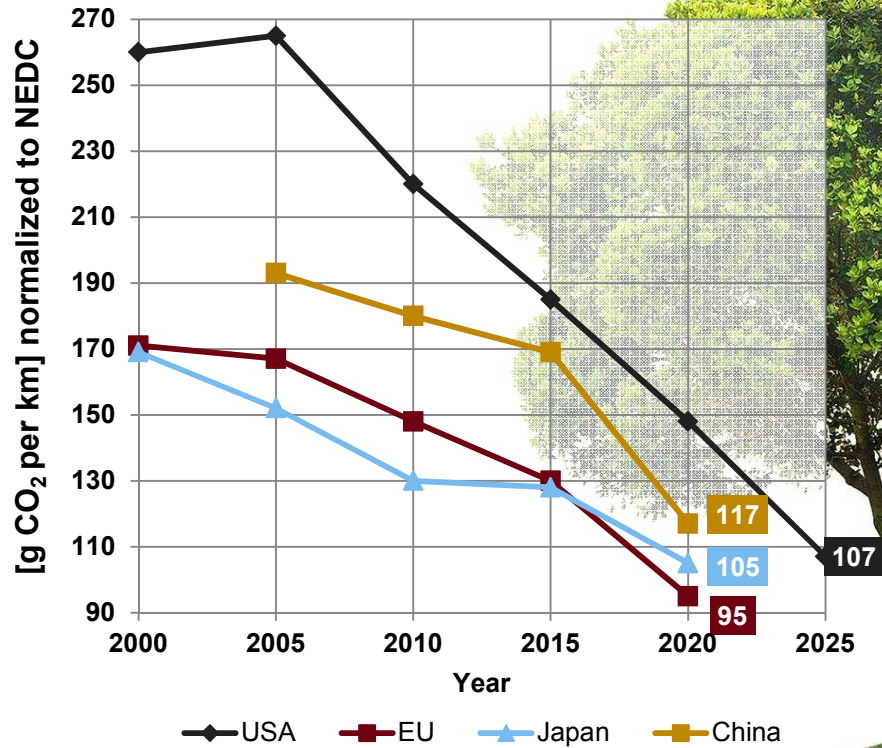
1957 model



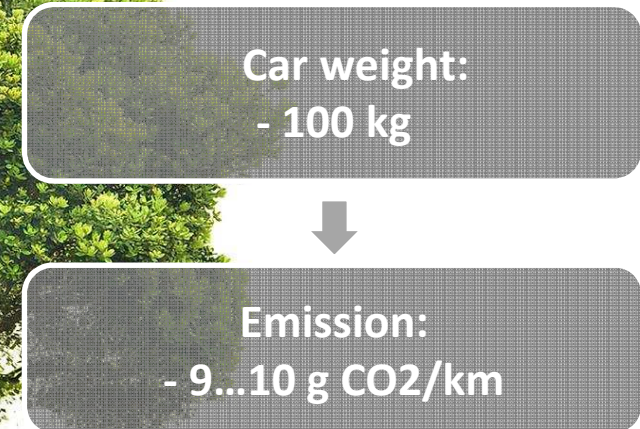
2015 model

## **ALUMINIUM** OFFERS NEW SOLUTIONS

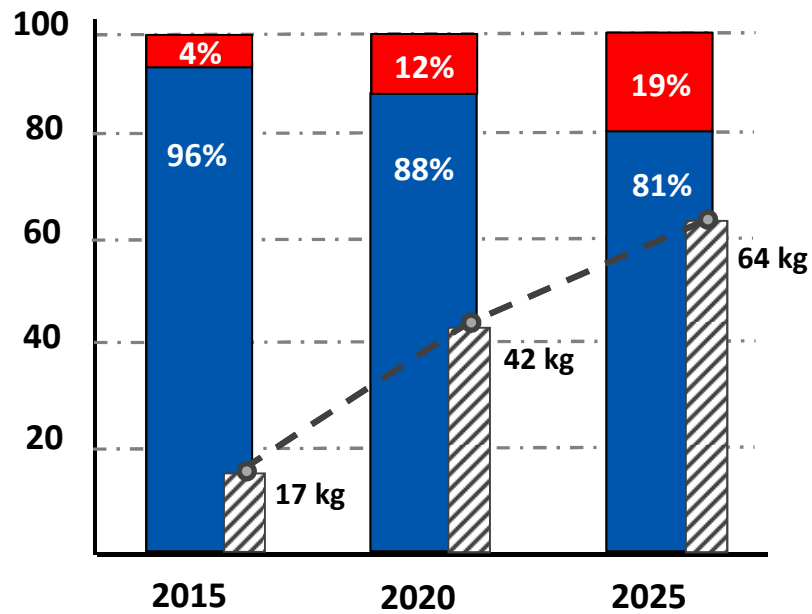
**CAR CO<sub>2</sub> EMISSION TARGETS BY NEW LEGISLATIONS**




**WEIGHT TO EMISSION EFFECTS**

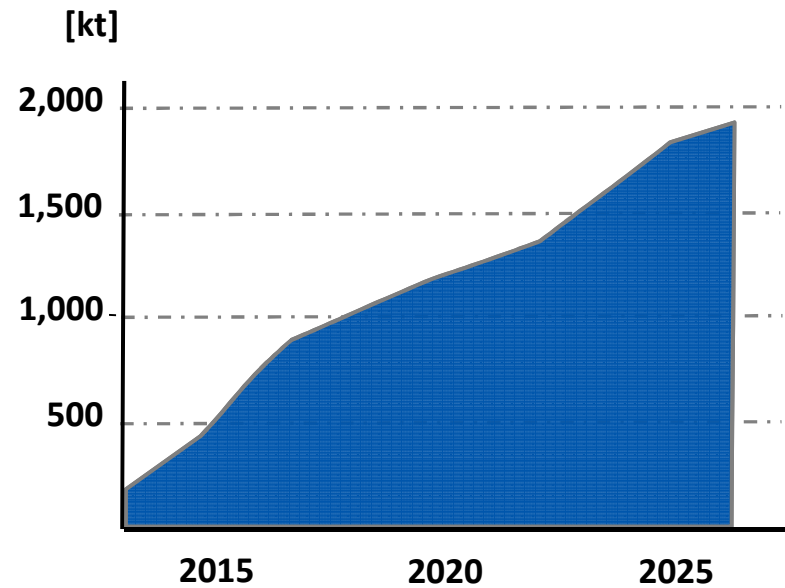


**WEIGHT PORTION OF AVERAGE US CAR (BODY & CLOSURE)**



- % of aluminium (sheet, extrusion, VD casting)
- % of steel (mild, HSLA, AHSS, UHSS)
-  kg of flat rolled aluminium sheet

**US CAR ALUMINIUM SHEET DEMAND (BODY & CLOSURE)**



Source: Ducker Worldwide (NA Light Vehicle Aluminium Content Study , 2014)

**SAFETY**

CRASH STRENGTH  
ENERGY ABSORPTION

**EFFICIENCY**

LESS CONSUMPTION  
LESS EMISSIONS

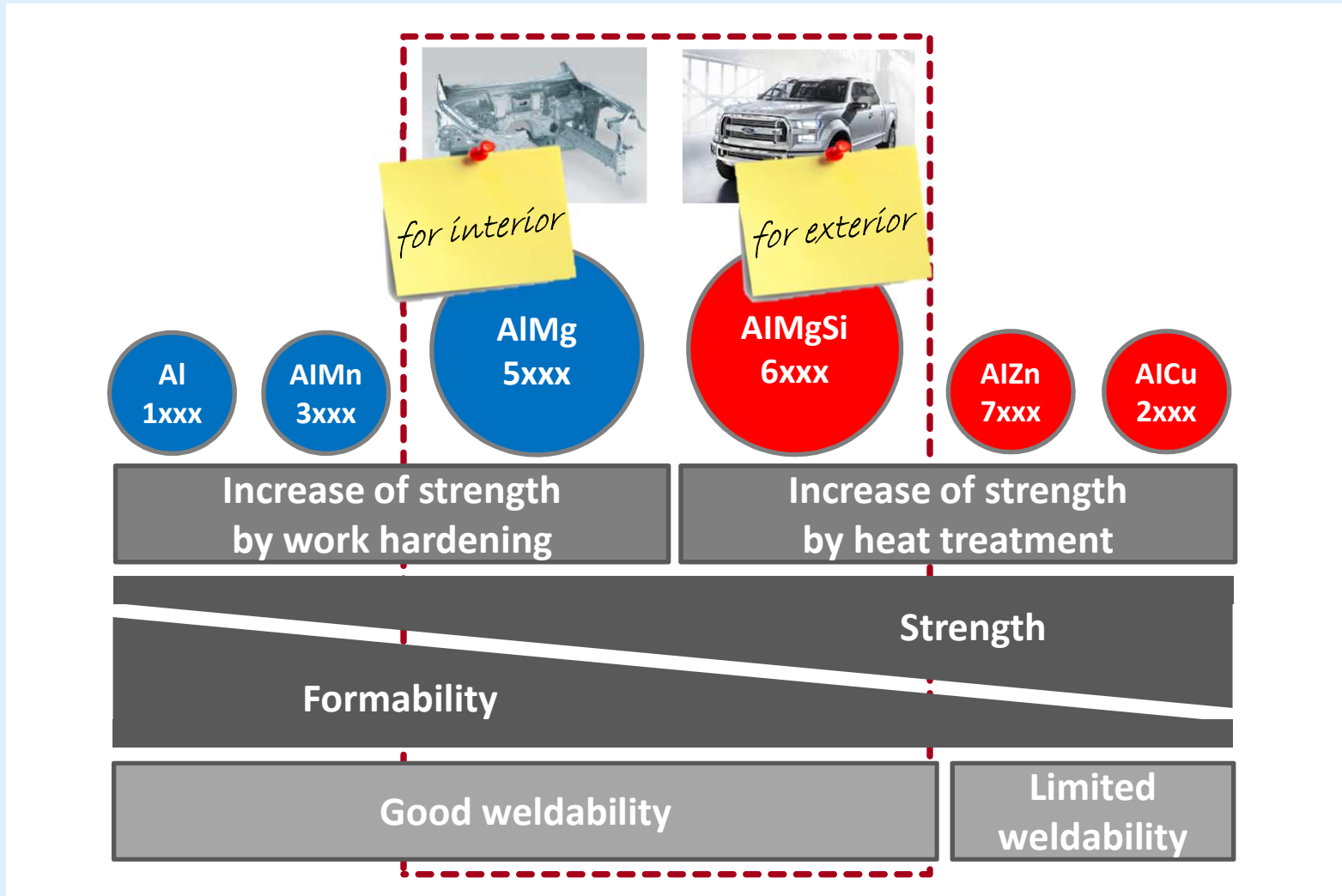


**SUSTAINABILITY**

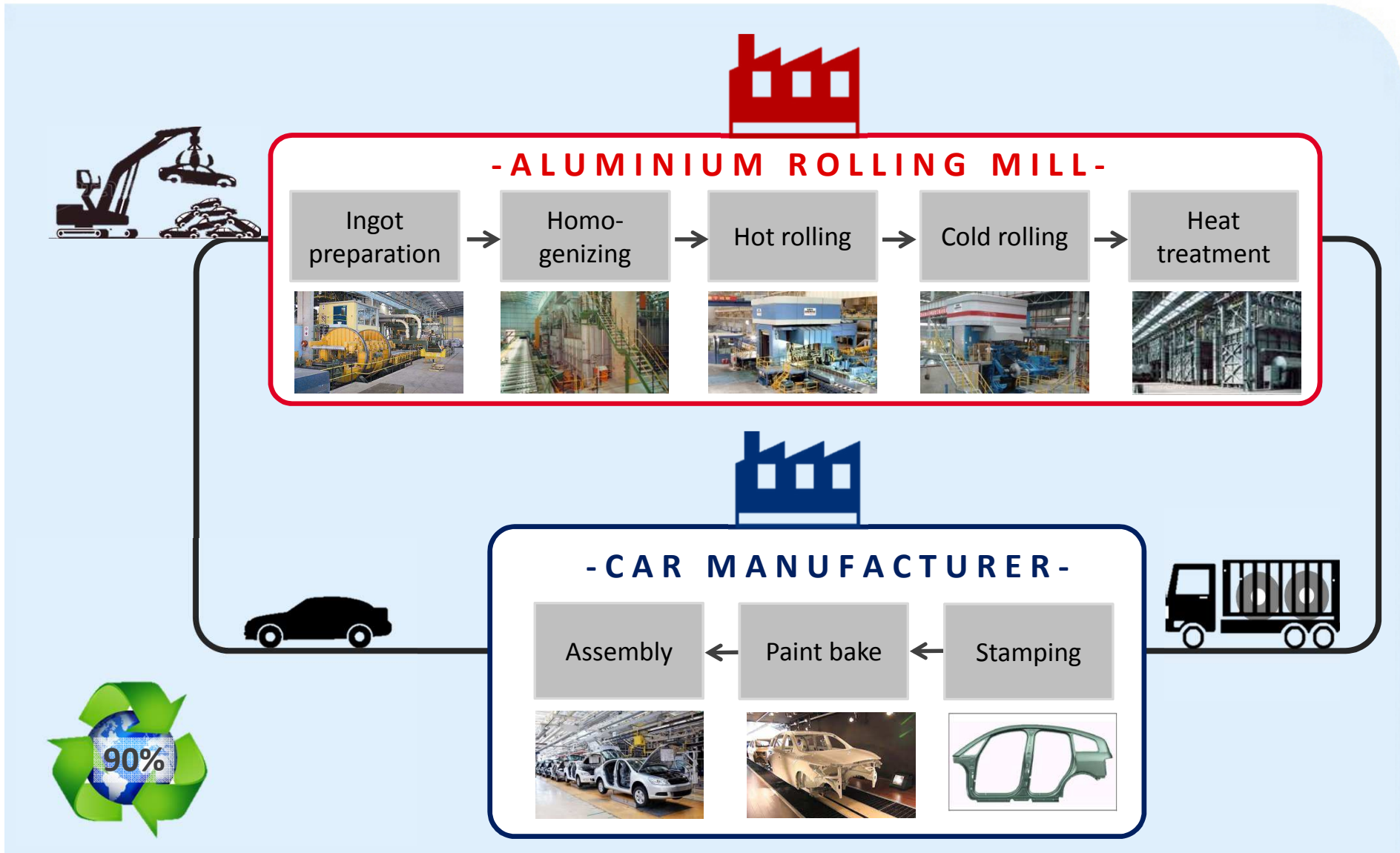
UNLIMITED RECYCLING  
CORROSION RESISTANCE

**DESIGN**

FORMABILITY  
SURFACE APPEARANCE





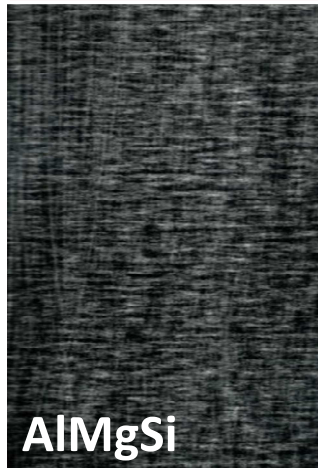


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**PREVENTING SURFACE DEFECTS**

**ROPING**



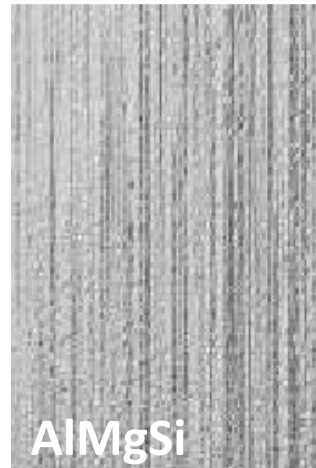
**AlMgSi**

**STRETCHER STRAINS**

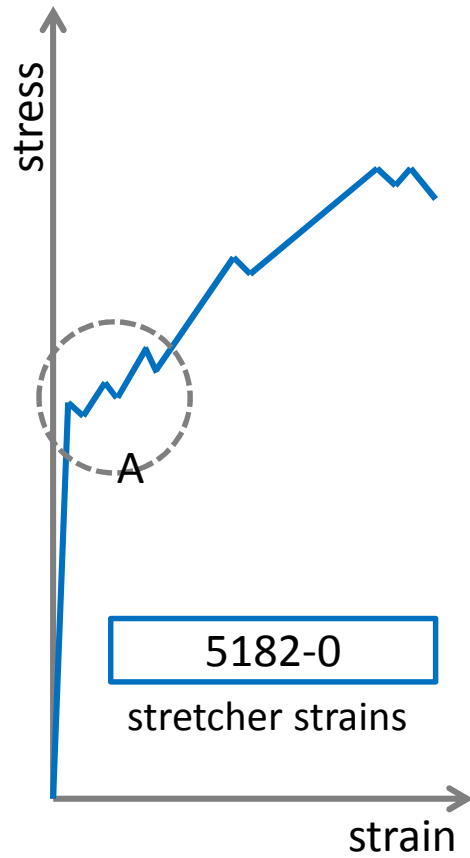


**AlMg**

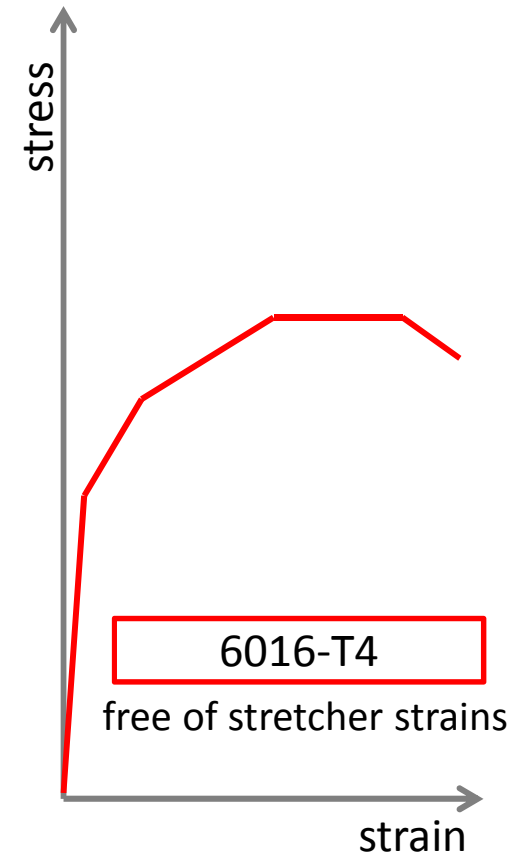
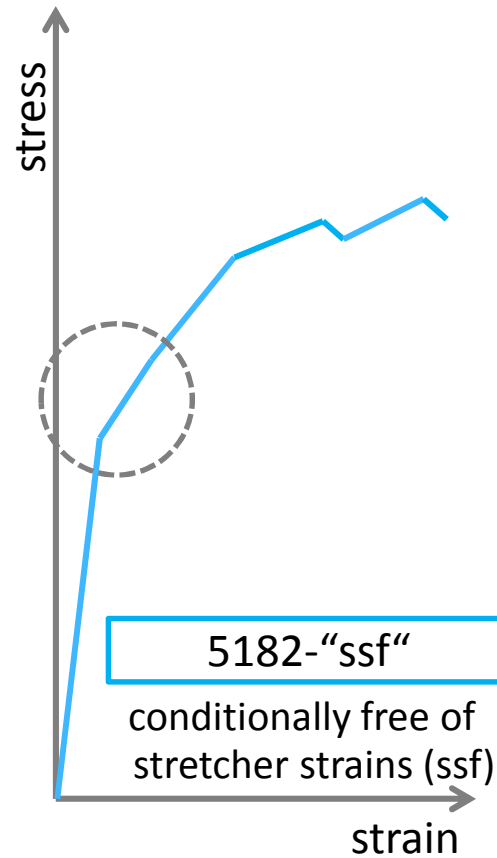
**ANISOTROPY**



**AlMgSi**



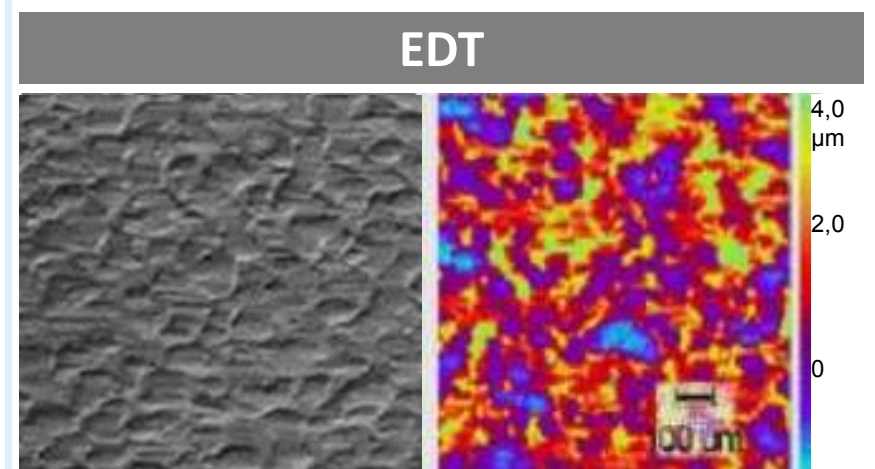
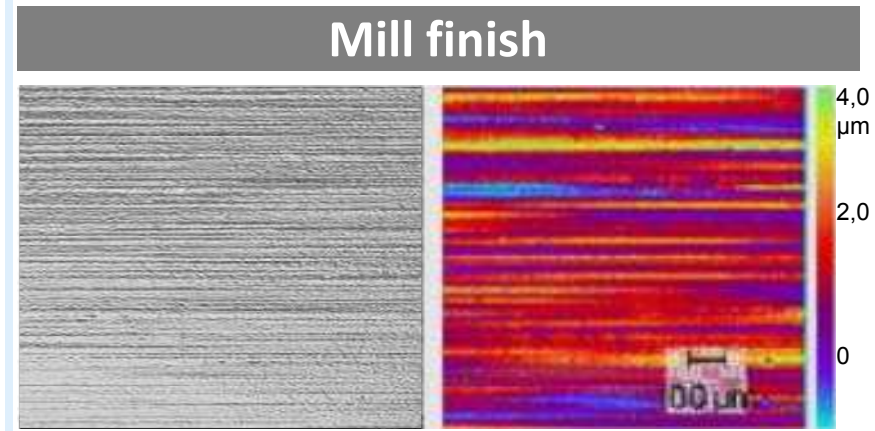
A = Lüders strain



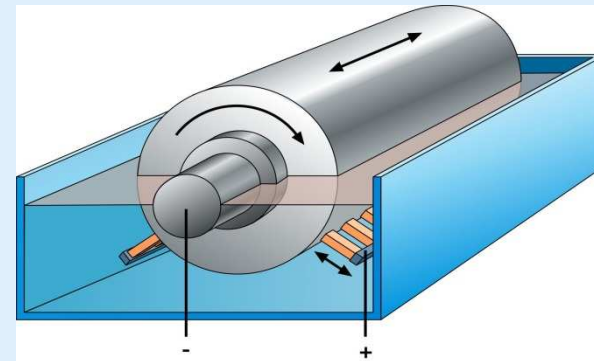
Source: IfU – Stuttgart / TALAT

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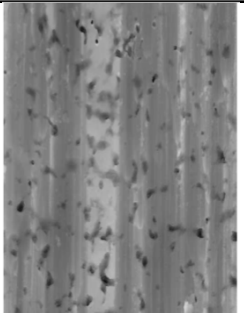
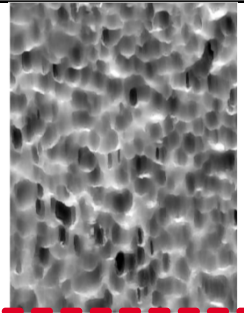
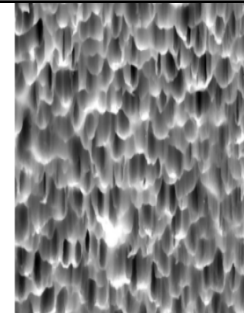
- Isotropic structure (no directional influence on the forming behavior)
- Lubrication pockets lead to build up of hydrostatic pressure
  - Low and regular friction coefficient
  - Better formability than with mill finish surfaces
  - Improves press-shop handling (de-stacking of blanks etc.)
  - Less pick-up of work piece material on the tool surface
- Improved lacquer appearance and panel matching (irrespective of orientation and material mix)

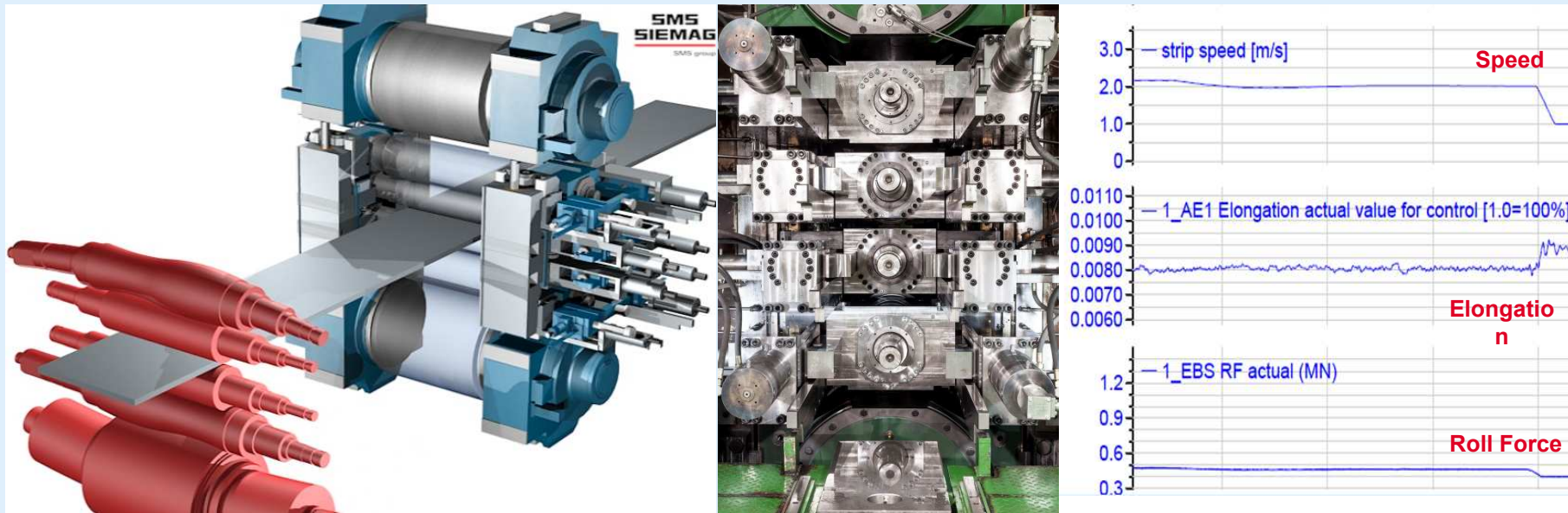


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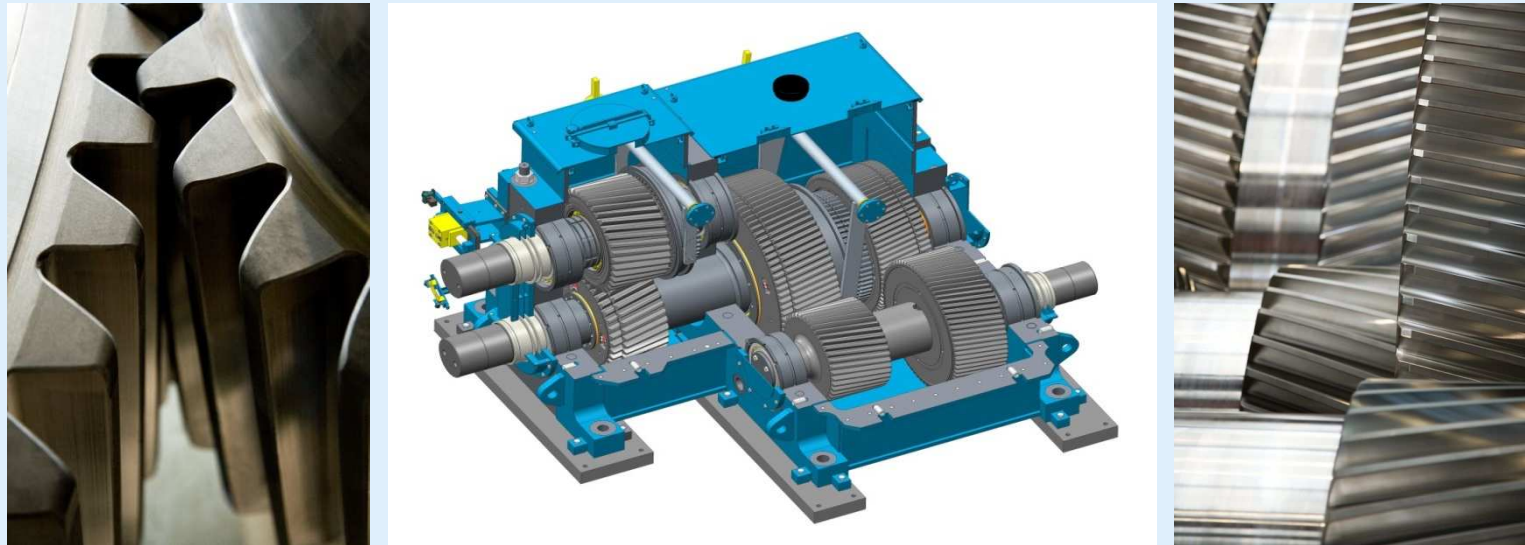
Fotos: SARCLAD Ltd, WSC GmbH

<b>REDUCTION</b>	$\epsilon = 0\%$	$\epsilon \approx 0.8\%$	$\epsilon \approx 4\%$	$\epsilon \approx 10\%$
<b>MEAN ROUGHNESS</b>	$Ra = 0.56\mu\text{m}$	$Ra = 0.74\mu\text{m}$	<b><math>Ra = 1.55\mu\text{m}</math></b>	$Ra = 1.82\mu\text{m}$
<b>ROUGHNESS TRANSFER</b>	No roughness (mill finish)	Low transfer	<b>Good transfer ISOTROPIC</b>	ANISOTROPIC transfer
<b>3D ROUGHNESS PROFILE</b>				



### EBS Extended Bending System

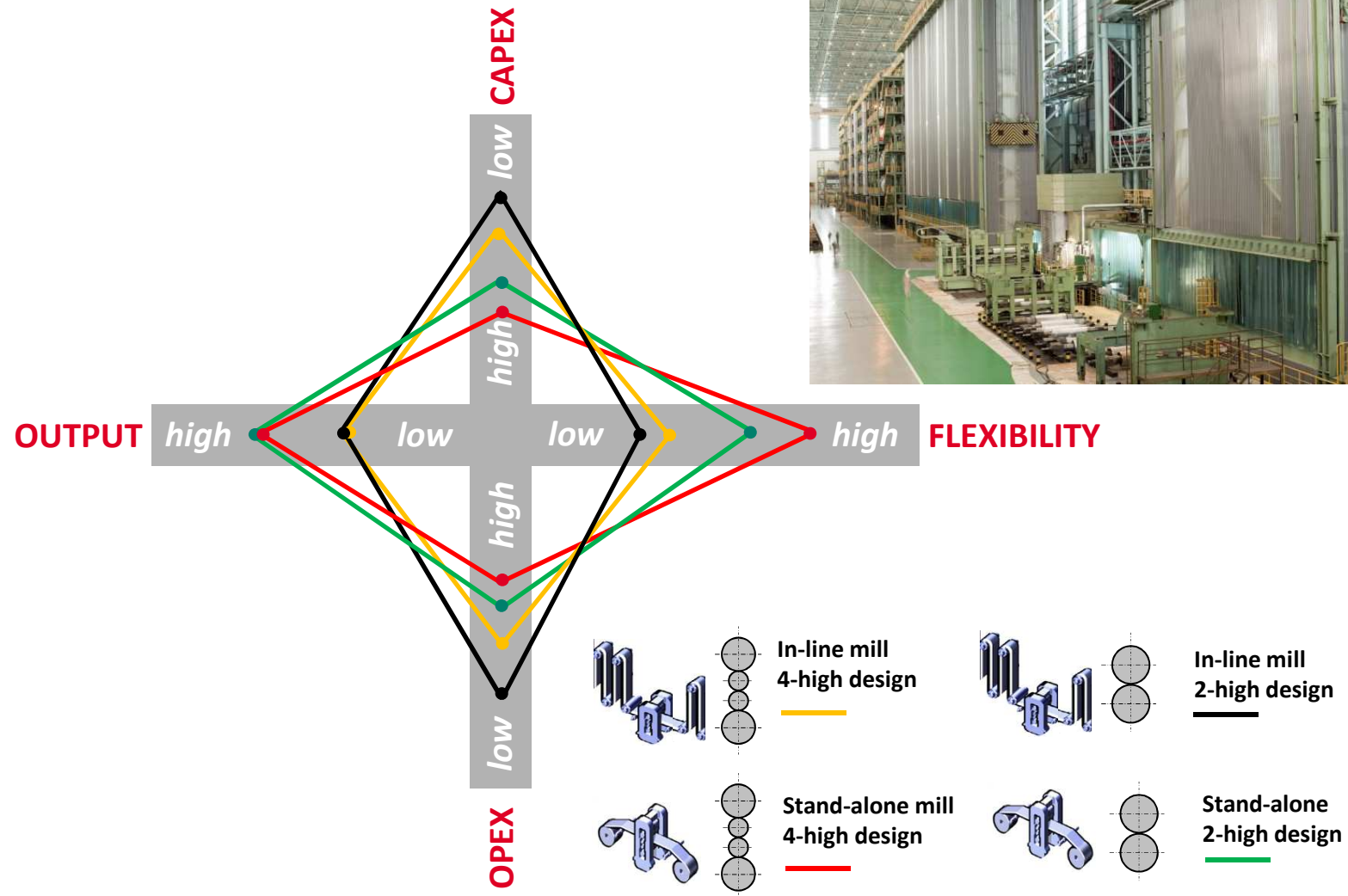
- Lifting of the upper back up roll
- Roll gap adjustment via roll bending system
- Controls lowest rolling forces for minimum strip reduction
- Future-oriented for EDT rolling of soft strips



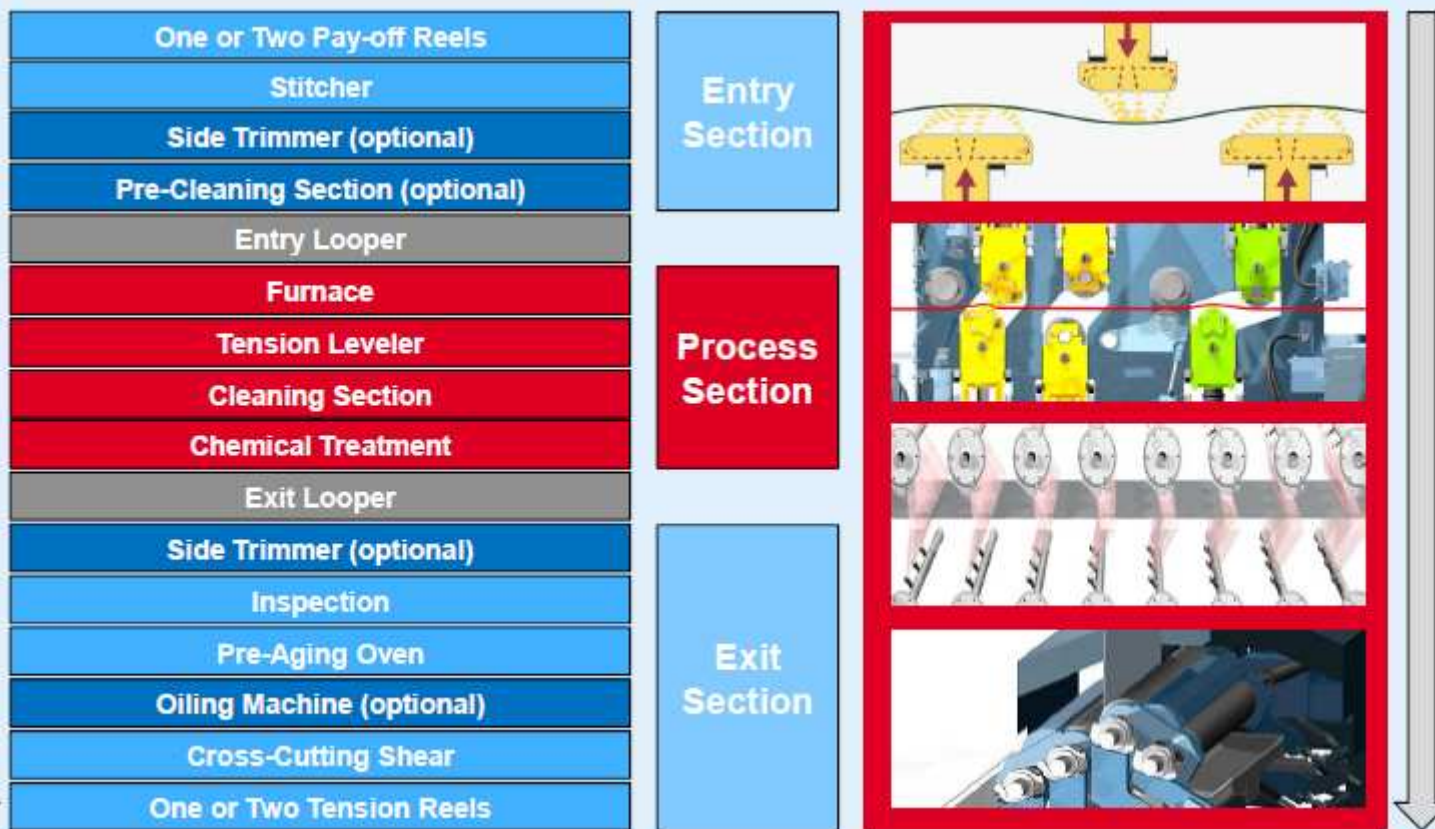
- One mill for combo operations: reduction and EDT skin passing
- Heavy reduction passes: Top and bottom work roll drive  
Soft EDT passes: Bottom work roll drive only
- Prevention from distortion between top and bottom work roll
- Transmission of low torque for sensitive skin passes



# SMS group Comparison of dedicated EDT mill concepts



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