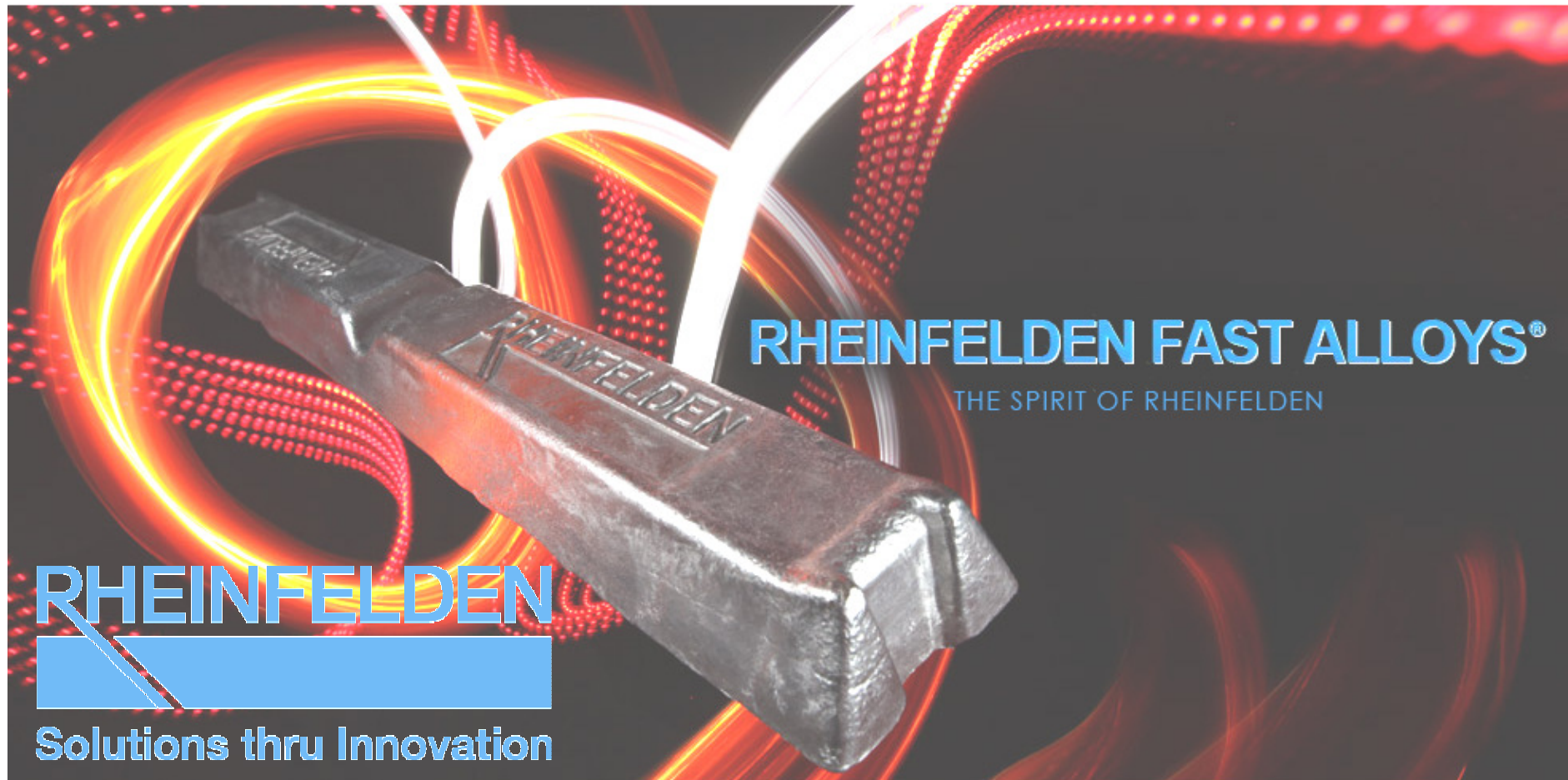


Solutions thru Innovation

RHEINFELDEN

With Silafont[®], Magsimal[®] und Castasil[®] to less CO₂ !



Roadshow 2012

Rüdiger Franke

CEO RHEINFELDEN ALLOYS GmbH & Co KG

Oct 2012

RHEINFELDEN ALLOYS strategic area:

1. Solutions thru Innovation:

- High grade alloys for the HPDC, for the „aggressive thin wall construction“ in Cast Aluminium
- with Castasil-37, Magsimal-59, Silafont-36
- Castasil-21 with higher conductivity for the rising electrification of vehicles



2. Rheinfelden Fast Alloys:

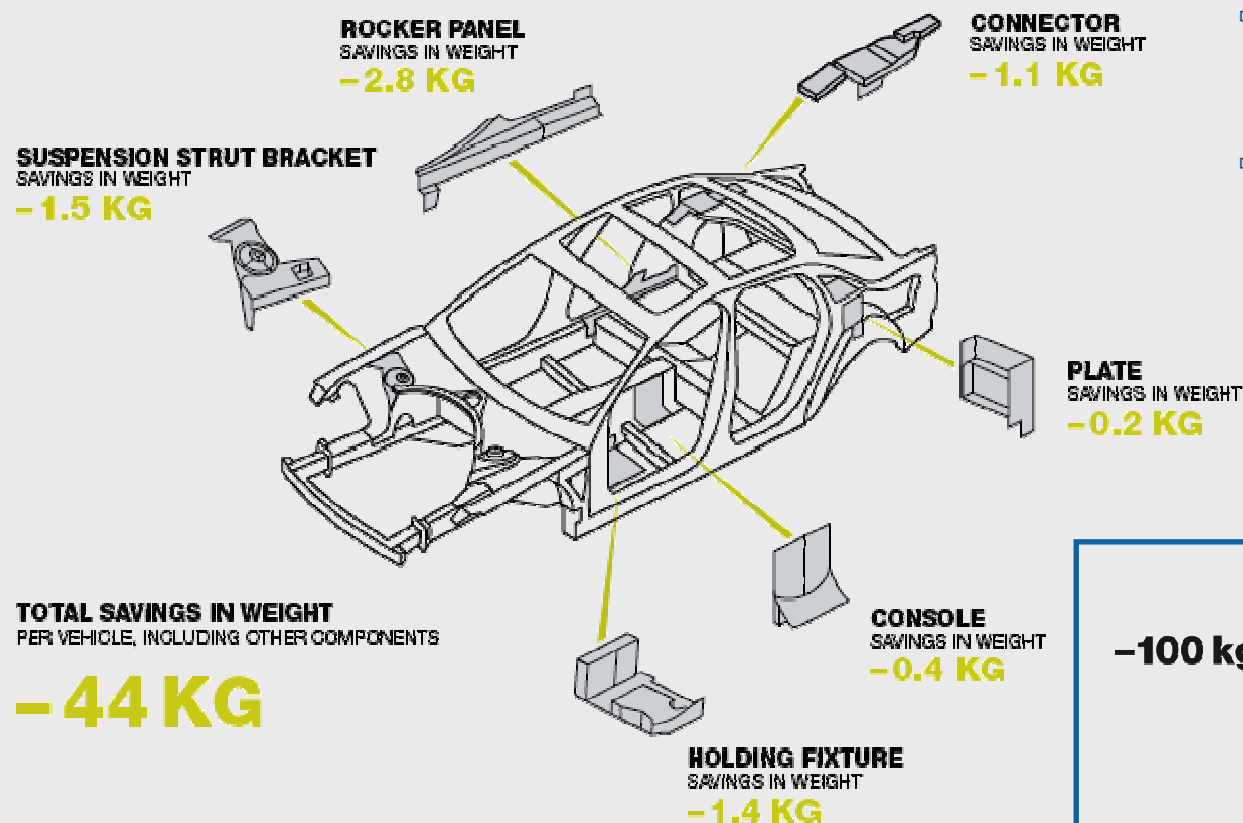
- Wide spread variants for specification & delivering amount
- short delivering times, highest quality within delivering and alloy composition



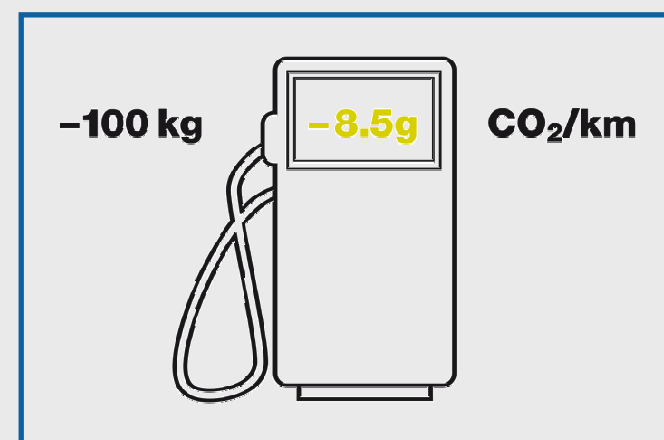
Trends of development in the automobile area from our RHEINFELDEN ALLOYS sight:

- **Automobile Structures:**
 - more and more light weight structures in aluminium high pressure die casting
 - Reduction of wall thickness
 - Integration of functions, castings are going to grow in size
 - Higher material strength is recommended
 - Deformability has to be given
- **Energy efficiency of the vehicles / Electromobility:**
 - Higher electric conductivity is recommended
 - thermal conductivity is recommended, esp. necessary for fuel systems with efficient concepts, aiming EU6
 - Heat spots have to be managed

Potential in reduction of CO2-emission with the use of modern HP Die Casting components:



- Examples from different vehicles
- Weight reduction in comparison to the recent generation



source: Bühler Druckguss, Uzwil

Advantages of aluminium in comparison to fibers:

- **Energy consumption:**
 - **Production of Carbon fibers needs the same energy amount**
- **Recycle-ability:**
 - **Al as metal can be recycled in a glance**
 - **By separating the alloy family a real recycling can be done, instead of „downcycling“**
 - **Al castings can be recycled to similar castings**
 - **Al recycling infra structure is established**
- **Al is a well known material**
 - **Joining techniques for automotive production are state of the art**
- **Carbon fibers are 10 times more expensive**

Chemical composition Silafont™-36 (Al Si10MnMg), AA 365, EN 1706:

good
Castability

no Sticking
to Die

Definition of
 $R_{p0,2}$, R_m , A

Modification
/ Ductility

	Si	Fe	Cu	Mn	Mg	Zn	Ti	Sr	Σ others
min	9,5			0,5	0,1		0,04	0,010	
max	11,5	0,15	0,03	0,8	0,5	0,08	0,15	0,020	0,2

no coarse
intermetallic phases

Chassis: Traverse Alfa Giulietta in Silafont®-36 F:



Source : Alfa Romeo

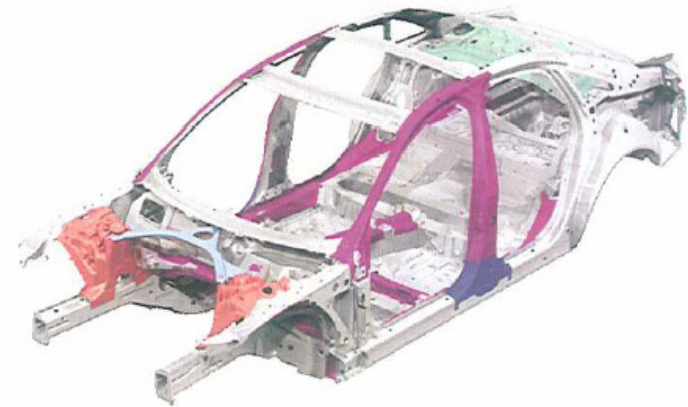


- **Use in the as cast state**
- **Monoblock-design substitutes a welded construction
=> weight reduction, less mounting costs**

Structure: shock tower in Silafont®-36 T7:



blechintensives
Karosseriekonzept



Audi A6 (1.400 Fzge/Tag)

Source : Audi AG

- Use in high volume production
- Highest recommended limits to strength & elongation
- riveted & welded

Chemical composition Castasil™-37, AlSi9Mn:

**excellent
castability**

**Yield
strength**

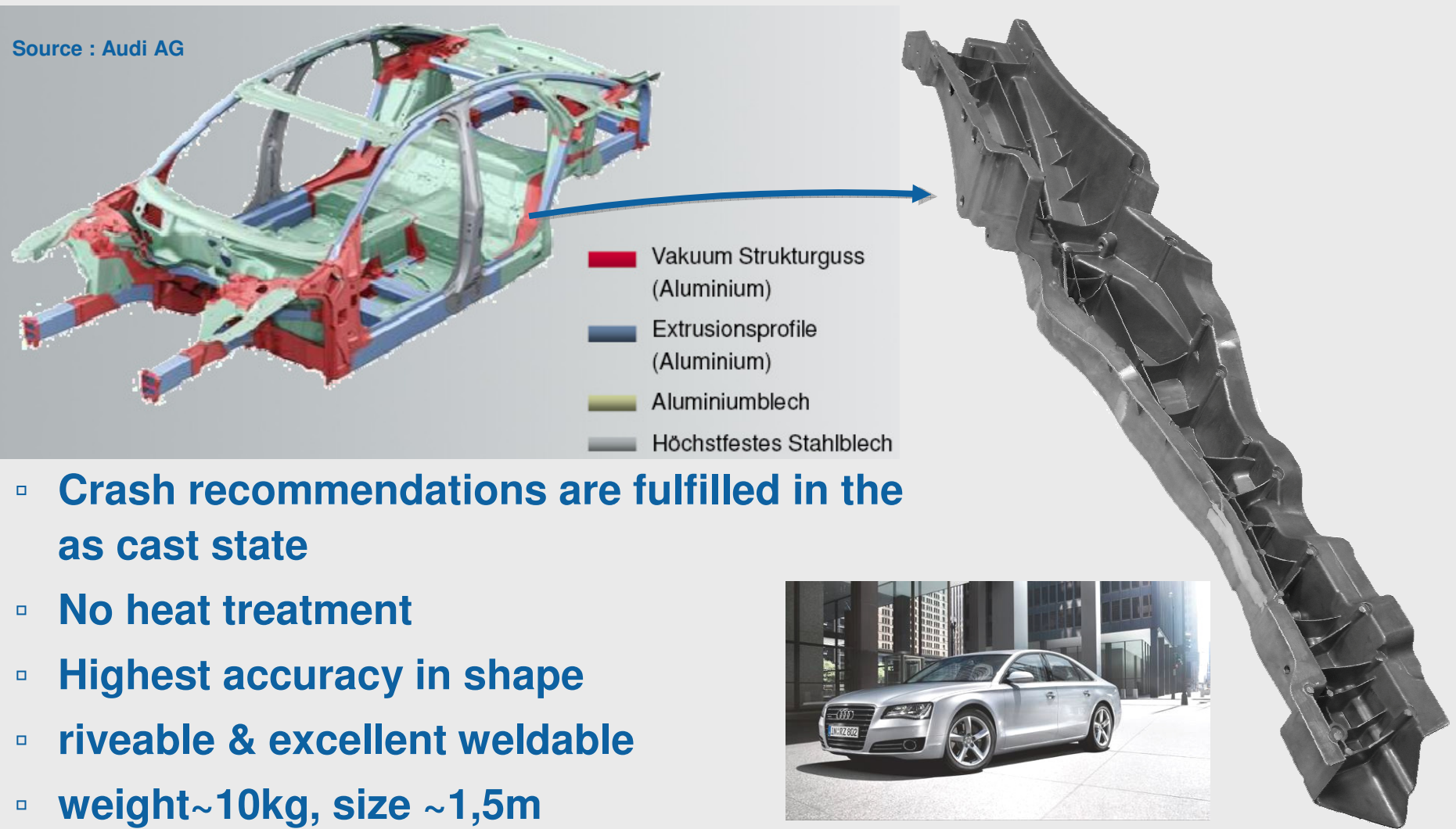
**Modification of
AlSi-Eutectic**

	Si	Fe	Cu	Mn	Mg	Mo	Zr	Ti	Sr	Σ andere
min	8,5			0,35		0,2	0,2	0,04	0,006	
max	10,5	0,15	0,05	0,60	0,06	0,3	0,3	0,15	0,025	0,2

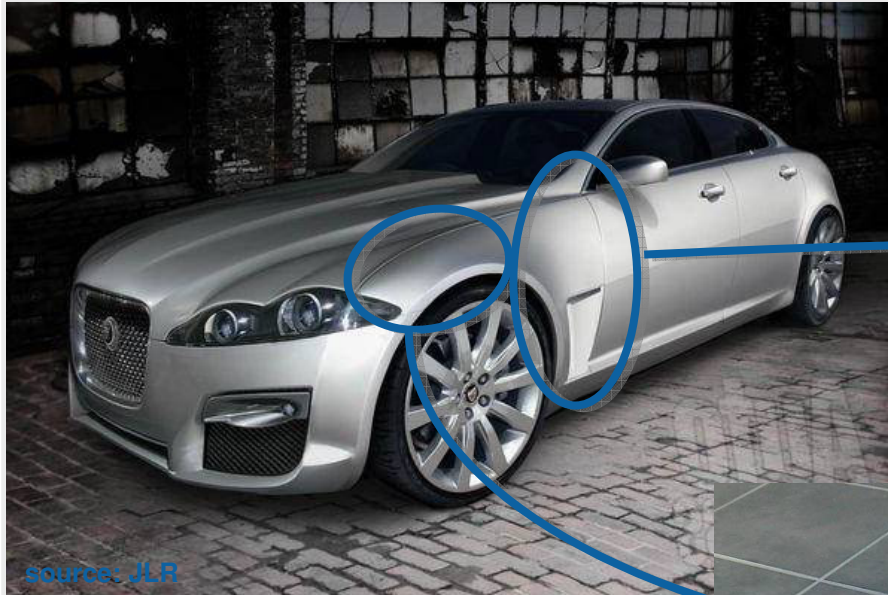
**no sticking to the die,
no disturbing phase**

**no long time aging of
the casting**

Structure: Joining part – ASF® Audi A8 in Castasil®-37 as cast :



Structure: Castasil®-37 in the front area of Jaguar XJ



- high accuracy in shape (without heat treatment)
- Crash limits in the front area are fulfilled in temper O
- riveted

Flaps: Castasil®-37 in VW Phaeton



- **Net-shape design with 1,8 – 2,0 mm casting thickness**
- **Laser cutting**
- **Use in the as cast state=> high accuracy in shape**
- **Monoframe design**

Chemical composition **Magsimal®-59**, AlMg5Si2Mn:

No soldering
problems

High Yield strength and elongation,
good corrosion resistance

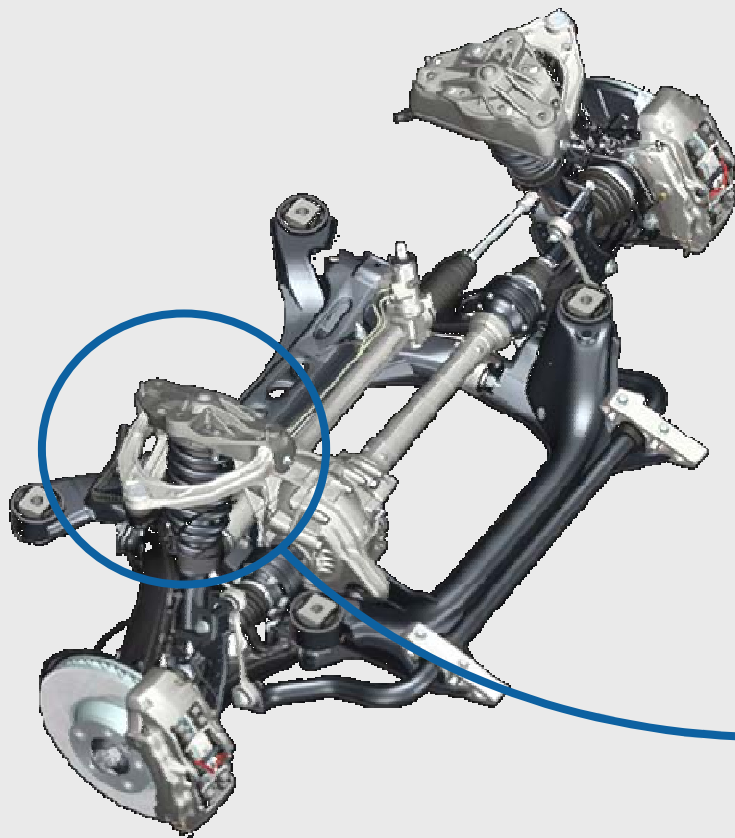
	Si	Fe	Cu	Mn	Mg	Zn	Ti	Be	Σ andere
min	1,8			0,5	5,0				
max	2,6	0,2	0,05	0,8	6,0	0,07	0,20	0,004	0,2

Mg₂Si-
eutectic

Reduce dross formation

Chassis: control arm in Magsimal®-59 in temper F (as cast)

- use in the Porsche Cayenne, Audi Q7, VW Touareg
- High strength and elongation in the as cast state, especially with thin wall thickness
 - No heat treatment
 - High dynamic load
 - highest corrosion resistance
 - weight 0,7 kg



Structure part in Porsche Panamera in Magsimal®-59 :



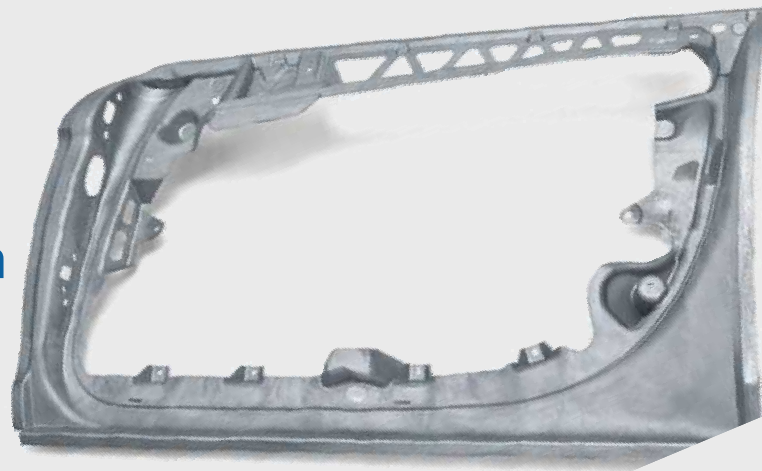
Shock tower:

- Integrated diagonal brace
- high fatigue strength
- high resistance against crack growth



Door frame:

- High stiffness in combination to low weight



Chemical composition of Castasil®-21:

**good
castability**

**low limits to archive
conductivity**

	Si	Fe	Cu	Mn	Mg	Zn	Ti	Sr	Σ andere
min	8	0,5						100	
max	9	0,7	0,02	0,01	0,03	0,07	0,01	250	0,2

No sticking

**Corrosion
resistance,
conductivity**

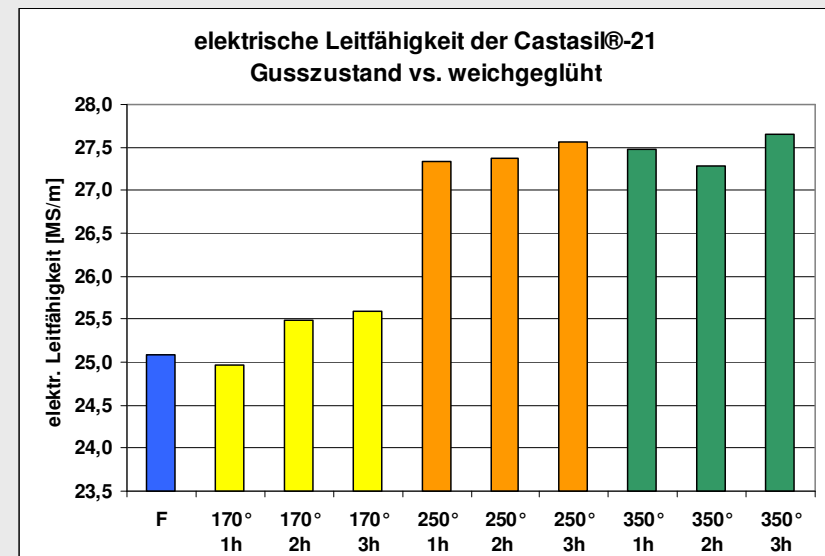
**AlSi
modification**

Castasil®-21 for electricity & heat conducting HPDC parts:



Example of source

- electric conductivity:
 - Up to $25 \cdot 10^6$ S/m in temper F
 - Up to $28 \cdot 10^6$ S/m in temper O (350 °C/ 60')
 - In comparison:
Al 99,7 L has $\sim 35 \cdot 10^6$ S/m
- Good castability, because of 8-9% Si
- Medium strength, $R_{p0,2} = 85-100$ MPa
- Medium hardness, 55-70 HB
- weldable
- rivetable / calkable



For further discussion :

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