

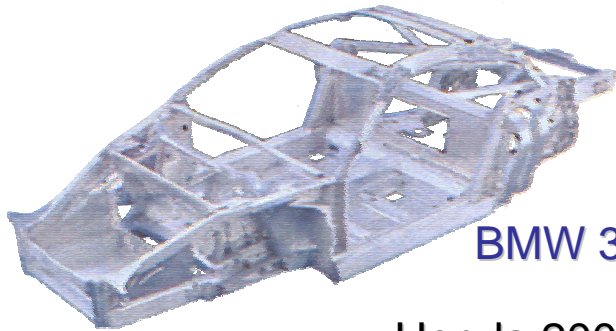
Structural Parts for Transportation Systems made from Aluminium

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Aluminium in Automotive Bodies and Suspension 2001 (samples)



Audi A2, A4, A6, A8

BMW 3er, 5er, Z8, Renault Aventime

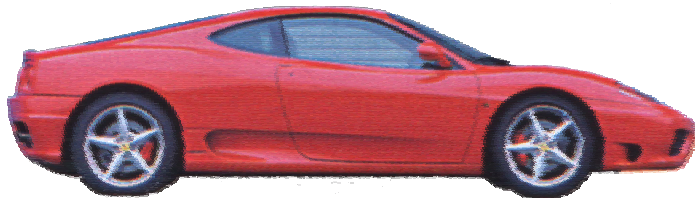
Honda 2000

Porsche Boxster, 911

Opel Corsa Lotus Elise, Opel Speedster, Ferrari 360 Modena

Mercedes C-Klasse, S-Klasse, Maybach, Rolls Royce

Lancia Thesis, Alfa GTV



Source: Auto Forum 1/2001



Strong Engagement of AI-Producers

Alusuisse / Alcan, Alcoa, Norsk Hydro, VAW, AMAG, SAG

Aluminium-intensive Audi A2



Body Sheet Al 6xxx; Extrusion Profiles Al 6xxx;
Vacuum Pressure Die Castings AlSiMg; AlMgSi
30 m Laser Weldings, 1800 Rivets

Source: Aluminium Today 1/2/2000

Body in Al - Sheet Design

Ford P2000



Source: ATZ 12/2000

Hydroformed Tank



Alcan:

1 m² Steel Sheet

DM 7,75

1 m² Al - Sheet

DM 13,30

1 m² Polymer Sheet

DM 17,90

1 m² Mg - Sheet

DM 19,70

Casting Processes for Structural Parts

Gravity Casting

Low Pressure Die Casting

Vacuum High Pressure Die Casting



Squeeze Casting

Thixocasting

New Rheocasting

Source: ATZ Sonderausgabe A4 11/2000

Quality Requirements to cast Structural Parts



low porosity

high ductility

heat treatable

weldable

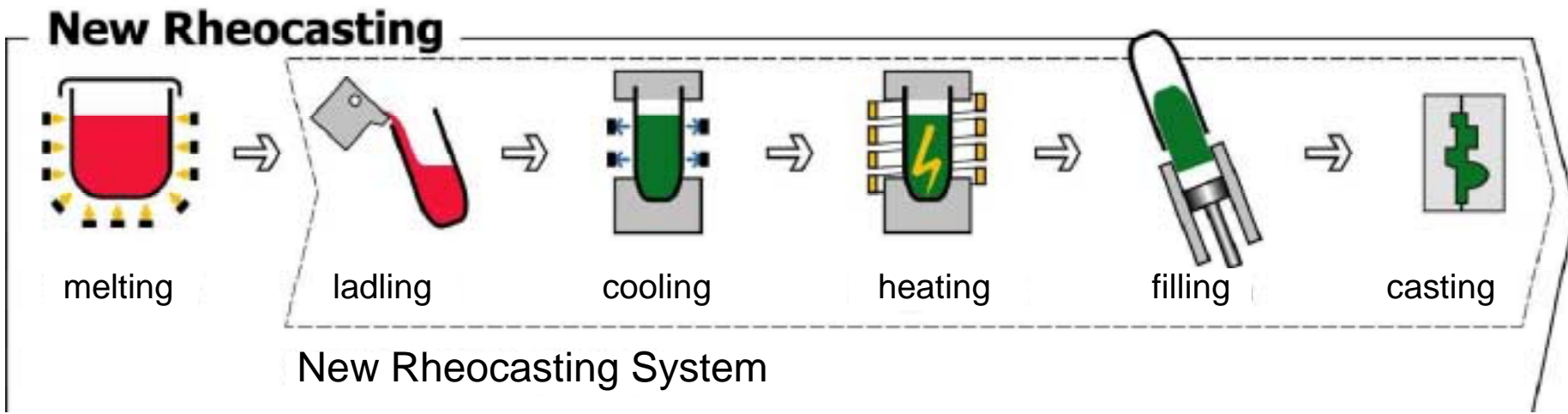
recyclable

low cost



Source: ATZ Sonderausgabe A4 11/2000

The New Rheocasting - Process



New Rheocasting



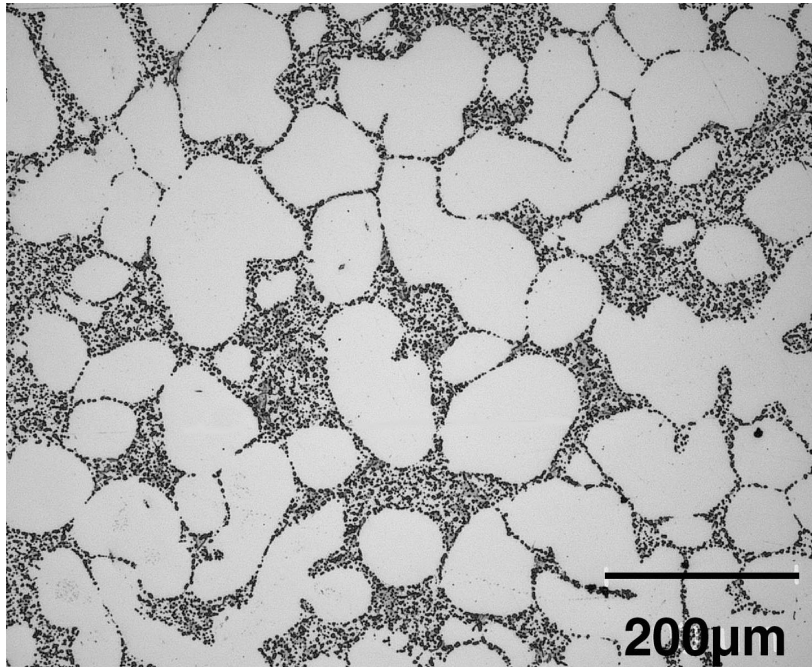
NRC Slurry maker

New Rheocasting

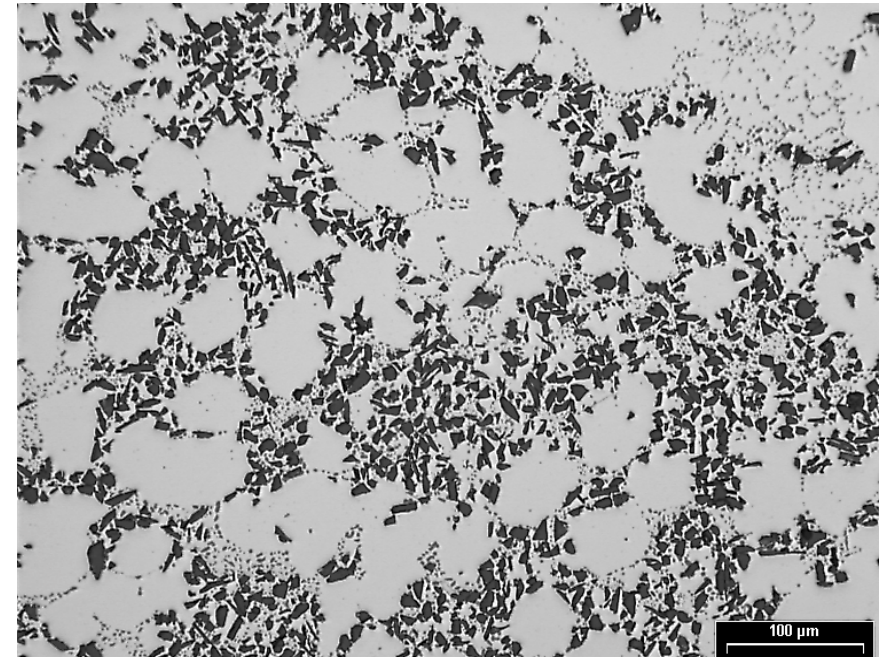


NRC Forming Process

Typical NRC Microstructure



AISi7Mg, T6



AISi7Mg + 15 % SiC, T6

Typical Mechanical Properties

	T5			T6		
	R _m [MPa]	R _p [MPa]	A5 [%]	R _m [MPa]	R _p [MPa]	A5 [%]
AlSi7Mg	270	190	8	305	230	14
AlSi7Mg + 0,2 Sc	320	230	4,5	---	---	---
AlSi7Mg + 15% SiC	---	---	---	355	315	1,1
Magsimal 59	305	200	6	---	---	---
6082	---	---	---	385	355	2,5

Influence of Volume Fraction Solid, V_s , on the Mechanical Properties

AlSi7Mg, T6, 10 mm Stufe				
V_s [%]	0	30	40	50
R_m [MPa]	293	290	290	305
R_p [MPa]	210	210	210	230
A [%]	9,9	10,5	13,8	14,0

Influence of the Fraction of Recycling Scrap, V_R , on the Mechanical Properties

AlSi7Mg; $V_s = 50\%$				
V_R [%]	0	20	40	60
R_m [MPa]	305	295	305	295
R_p [MPa]	230	225	235	230
A [%]	14,0	12,0	13,5	12,5

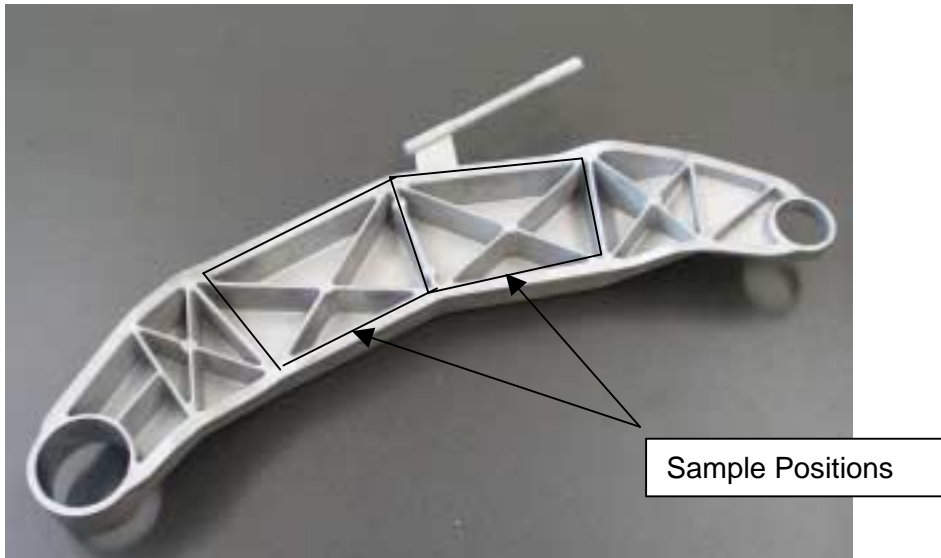
NRC - Welding Trials

LKR - Trial Part

AlSi7Mg

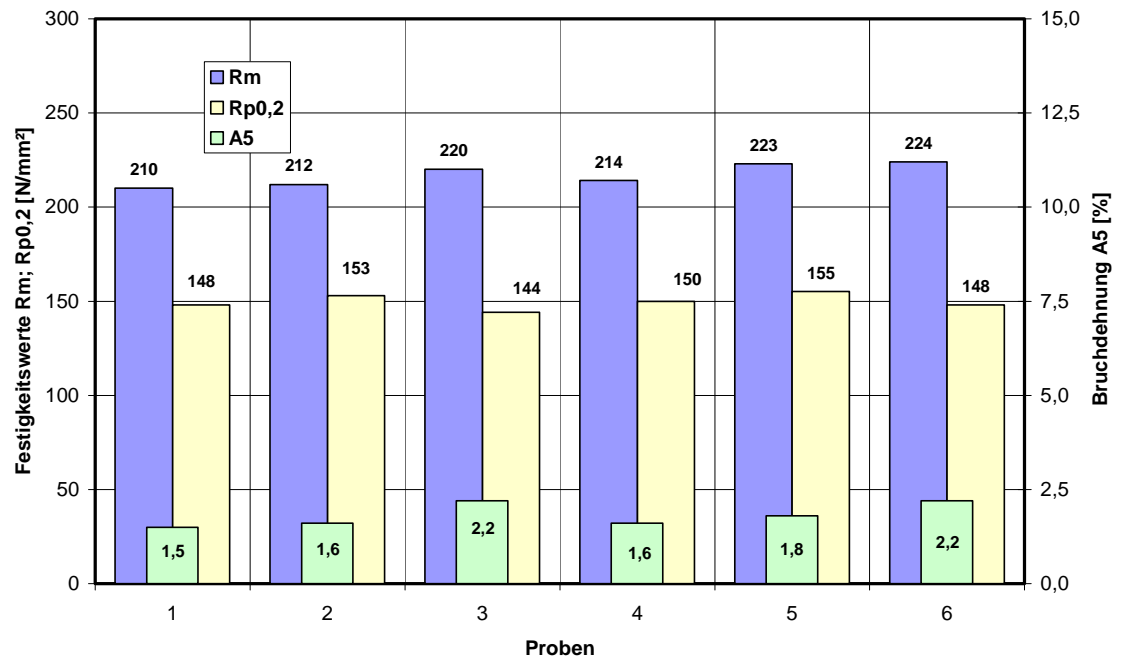
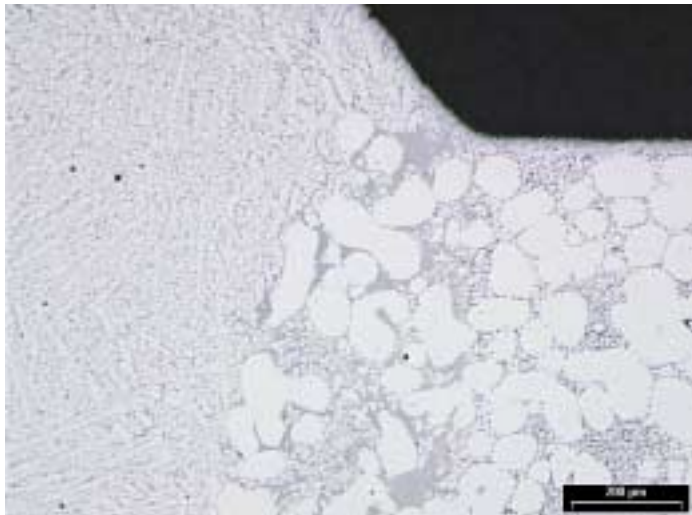
Laser-Hybrid Welding

Filler Material AlSi5



Microstructure and Properties after NRC - Welding

Werkstoffkennwerte von Laser-Hybrid geschweißten NRC-Querlenkerproben, Werkstoff A356

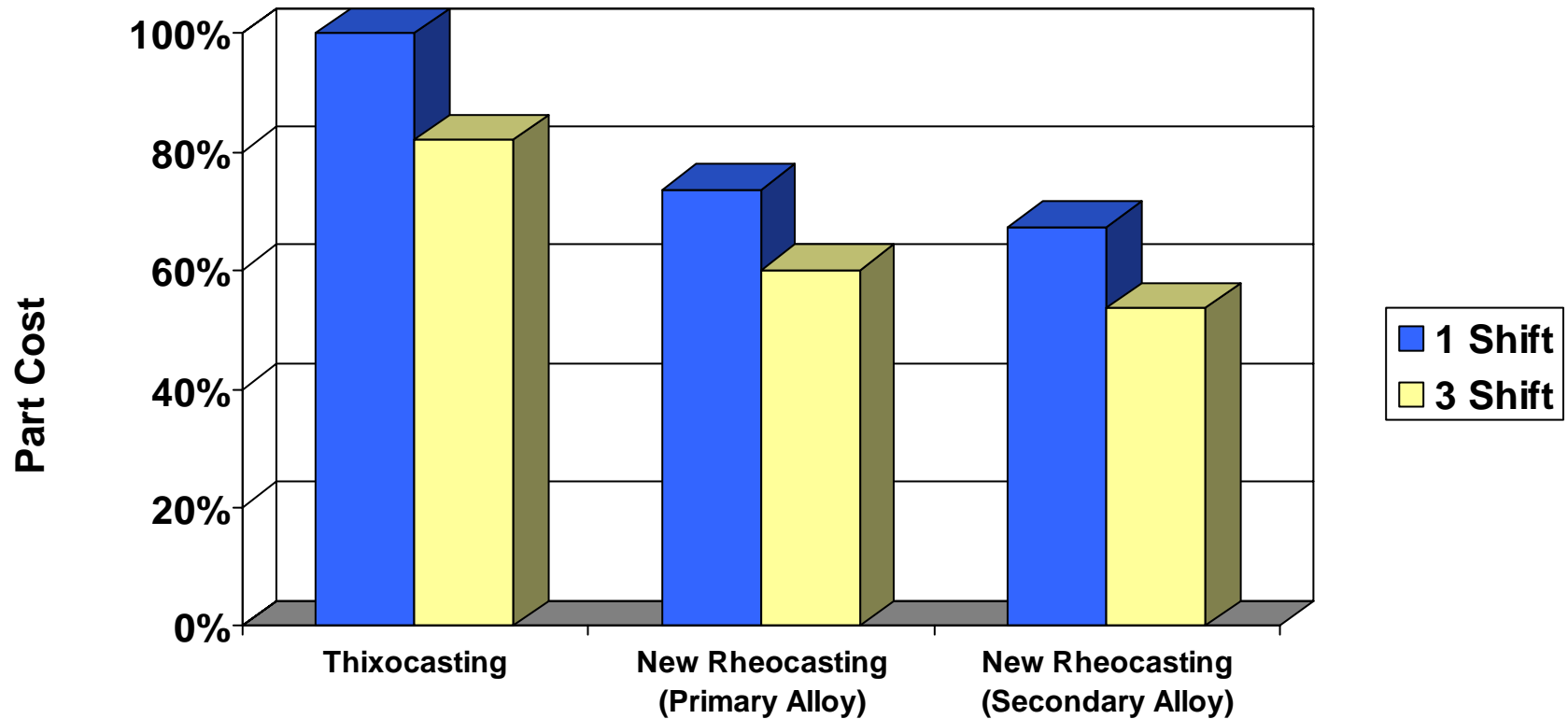


Accumulated Energy Consumption (KEA)

$$KEA = KEA_H + KEA_N + KEA_E$$

	Squeeze Casting	New Rheocasting	Thixocasting
KEA	1	1,02	1,95

Cost Comparison for Thixocasting and NRC



Summary

- Various new cars show high Al-content in body and suspension
- Weight Saving 30 - 50% compared to Steel or Cast Iron
- Modern Casting Technologies allow complex shapes
- NRC is a new Process for Structural Parts
- Recycling laws are in favor of Al and NRC



Source: Auto Forum 1/2001