



PASSIVE SAFETY AND LIGHTWEIGHTING USING ALUMINUM EXTRUSIONS

- BACKGROUND
 - **8 HOPES AND BELIEFS FOR ALU 2025**
-

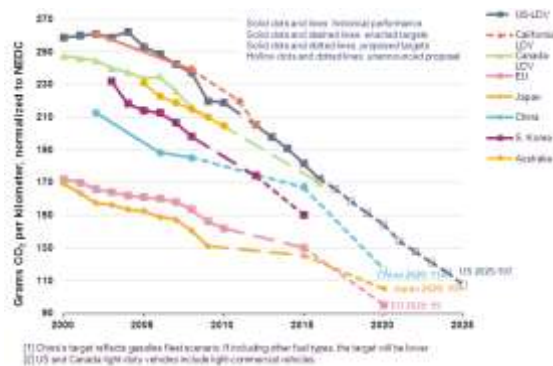
Background

Automotive Frontiers.

mainforum2025.com

Driving force for lightweighting

- Economical, environmental and political pressure:
 - reduce fuel consumption and CO₂-emissions



Automotive Frontiers.

mainforum2025.com

Material in 2025

- Mild steel will be replaced by a mix of materials, in top are:

- Aluminum
- High strength steel
- Fibre-reinforced-plastics



➤ Aluminium has the highest weight saving potential

Automotive Frontiers.

mainforum2025.com

8

Hopes and Beliefs for aluminum 2025

Automotive Frontiers.

mainforum2025.com

1

Avoid **unsafe** and **defective** design

Automotive Frontiers.

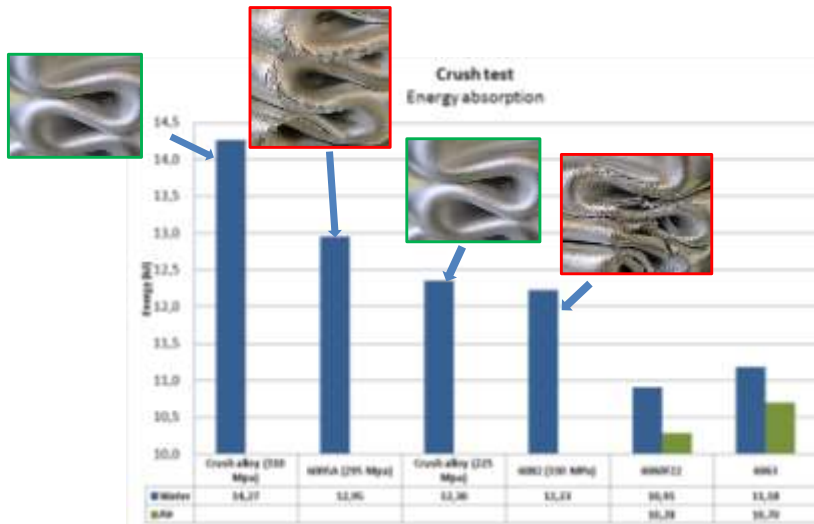
mainforum2025.com



- Which profile would you like to have in your car?

Automotive Frontiers.

mainforum2025.com



Automotive Frontiers.

mainforum2025.com

2

Lightweighting across the full range

- from Premium to Economy

Automotive Frontiers.

mainforum2025.com

Full range – Lightweighting as intended



Automotive Frontiers.

mainforum2025.com

3

High **volumes** for optimised **production** and **performance**

Automotive Frontiers.

mainforum2025.com



Automotive Frontiers.

mainforum2025.com



Automotive Frontiers.

mainforum2025.com

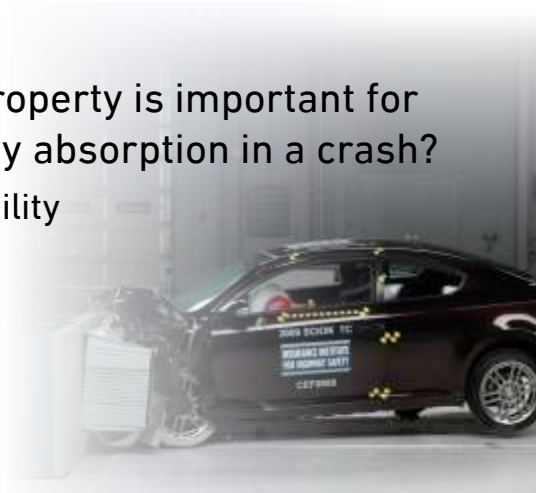


Focus on **relevant** properties

Automotive Frontiers.

mainforum2025.com

- What physical property is important for aluminum energy absorption in a crash?
 - Elongation/Ductility
 - Strength
 - Other property?



Automotive Frontiers.

mainforum2025.com

Alloy Comparison – same strength and elongation

Alloy A



Alloy B



Rp0.2 / Rm / A5 / crush grade
~ 290 / 306 / 13-14 / 9 (alloy A), 3 (alloy B)

Automotive Frontiers.

mainforum2025.com

Alloy Comparison – same strength and elongation

Alloy A



Alloy B



Rp0.2 / Rm / A5 / crush grade
~ 290 / 306 / 13-14 / 9 (alloy A), 3 (alloy B)

Automotive Frontiers.

mainforum2025.com

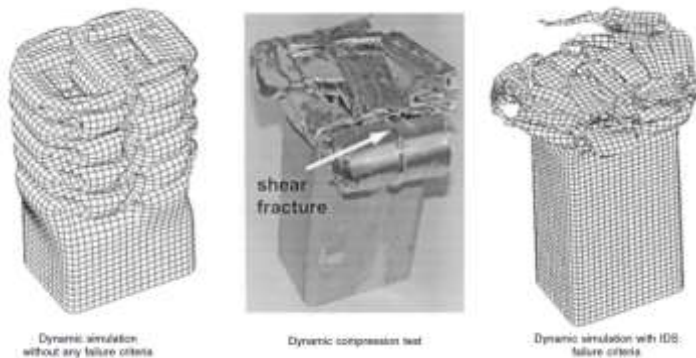
5

Advanced material models with failure criteria

Automotive Frontiers.

mainforum2025.com

- Failure criterias are needed to show the poor performance of standard alloys



from paper presented by BMW

Automotive Frontiers.

mainforum2025.com

6

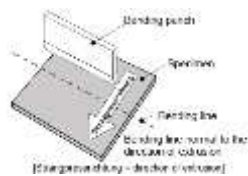
Standardized tests for crash performance

Automotive Frontiers.

mainforum2025.com

3-point bend test

- Quantative material test



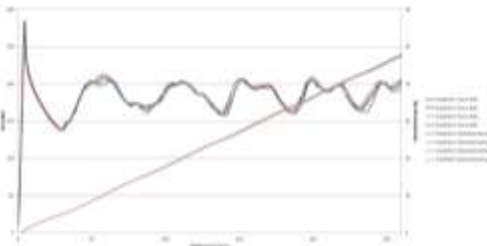
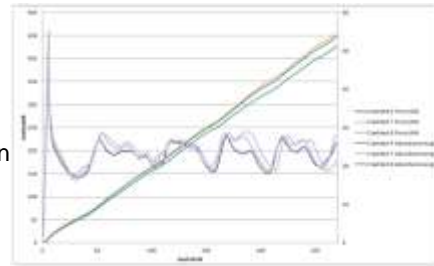
6082 (300345/10)	90° α 14°	45° α 27°	0° α 56°
Crash alloy (310325/11)	α 33°	α 61°	α 120°

Automotive Frontiers.

mainforum2025.com

Quasistatic compression

- Material and component test
- Quantative force energy absorption
- Subjective crash grading
- Peak and average force

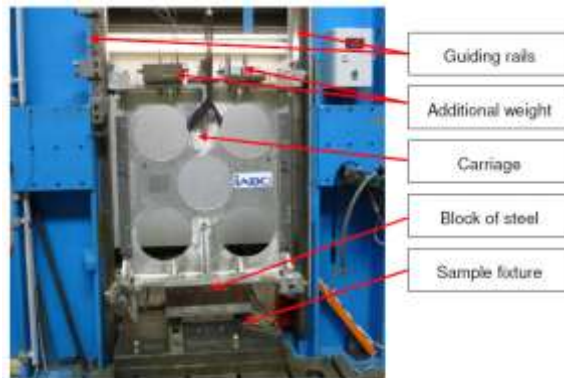


Automotive Frontiers.

mainforum2025.com

Dynamic Compression

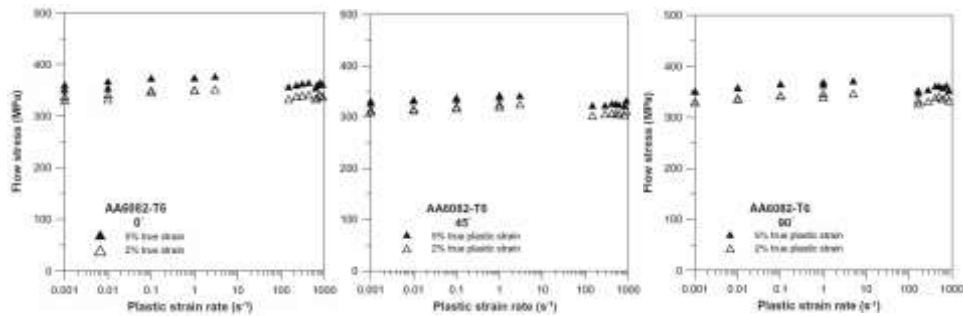
- Material and component test, expensive and complicated



Automotive Frontiers.

mainforum2025.com

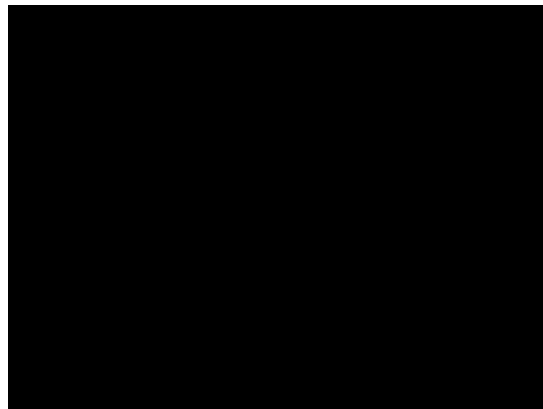
- The properties for 6xxx-alloys can be considered as independent on strain rate
 ⇒ dynamic testing and quasistatic testing should give the same results



Y. Chen, A.H. Clausen, O.S. Hopperstad and M. Langseth: *Stress-strain behaviour of aluminium alloys at a wide range of strain rates. Int. J. of Solids and Structures*, Vol 46, pp. 3825-3835 (2009).

Automotive Frontiers.

mainforum2025.com



Automotive Frontiers.

mainforum2025.com

...which is our experience as well



Dynamic



Quasistatic

Automotive Frontiers.

mainforum2025.com

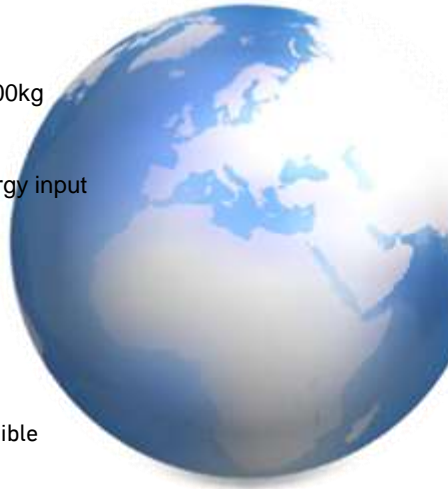


Recycling for **sustainability**

Automotive Frontiers.

mainforum2025.com

- Energy consumption for producing 1000kg prime aluminum is 30 000 kWh
- Recycling only requires 5% of the energy input
- Scrap separation is very important
 - Keep to one alloy series...
 - ...or make sure separation is possible



Automotive Frontiers.

mainforum2025.com



Joint development for optimal solutions

Automotive Frontiers.

mainforum2025.com

Joint development at an early stage in terms of...

- Alloy choice
- Profile design
- Avoiding dimensional restrictions
- Adding triggers
- Process routes

...is the key to success and optimal solutions!

Automotive Frontiers.

mainforum2025.com

➤ Partner with Sapa for a lighter and stronger future!



Automotive Frontiers.

mainforum2025.com



Jonas Braam
Sapa Technology

612 81 Finspång, Sweden

Tel: +46 733 22 32 22

Jonas.Braam@sapagroup.com

MF2025

Automotive Frontiers.