

Lightweight High Performance Materials for Car Body Structures

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Invited speaker



Presentation Outline

- Introduction
- Why lightweight high performance materials?
- Techniques to reduce car weight
- Existing materials and structures
- Potential for Fibre Composites
- Structural analysis
- Conclusion

Reasons for lightweight Materials

- Environmental issues
- Improve performance
- Improve production methods
- Reduce fuel costs
- Reduce total cost of the car

To reduce vehicle weight

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graph TD; A[To reduce vehicle weight] --> B[Material lightweight construction]; A --> C[Structural lightweight construction]; A --> D[Optimising of production process];
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Material lightweight construction

- Unreinforced and reinforced plastic
- Aluminium Magnesium
- High strength Steels
- Metal foams

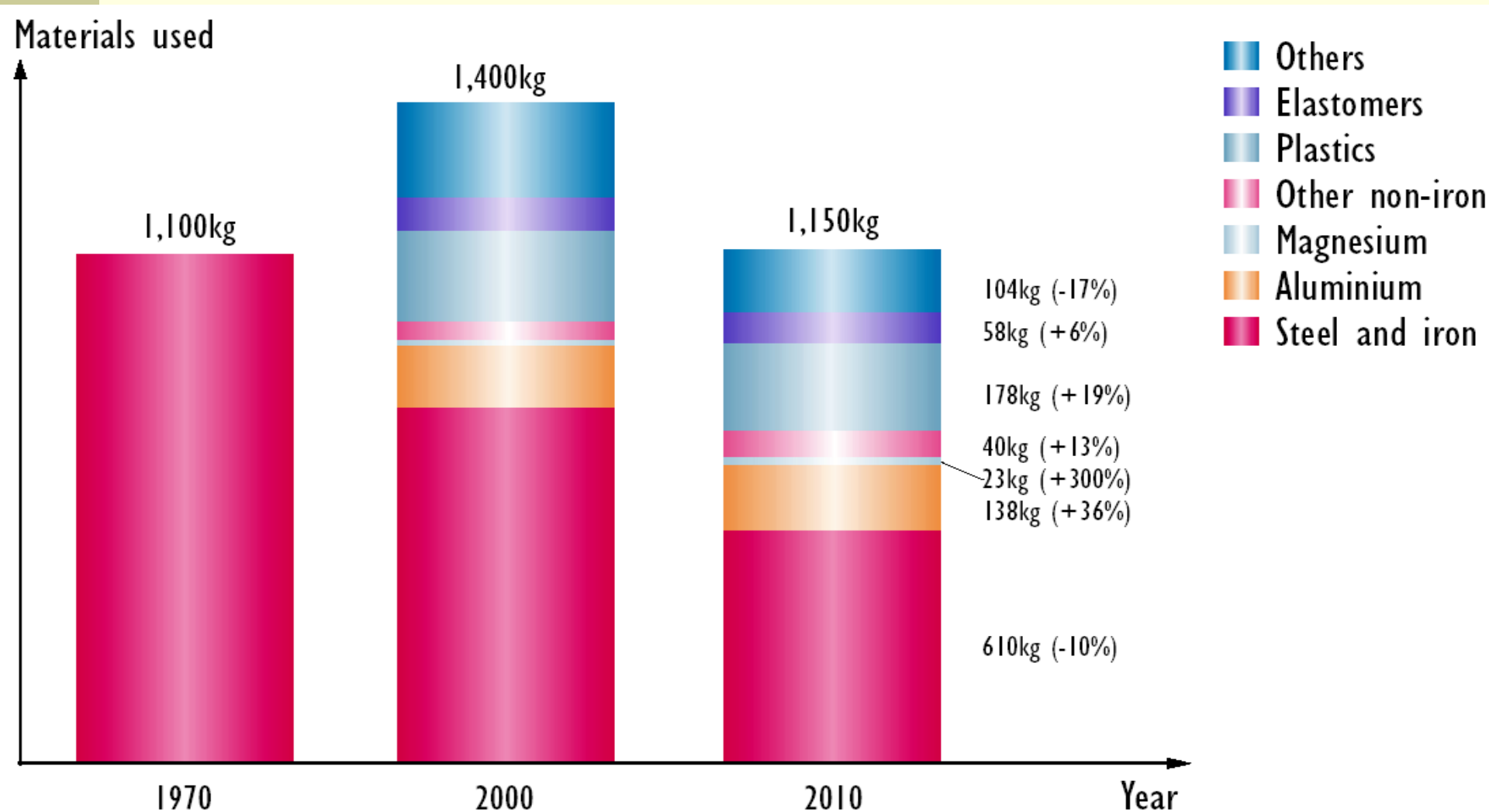
Structural lightweight construction

- Tailored blanks / patchwork
- Profile / tubular structure
- Optimised joint design
- New structure and complex strategic

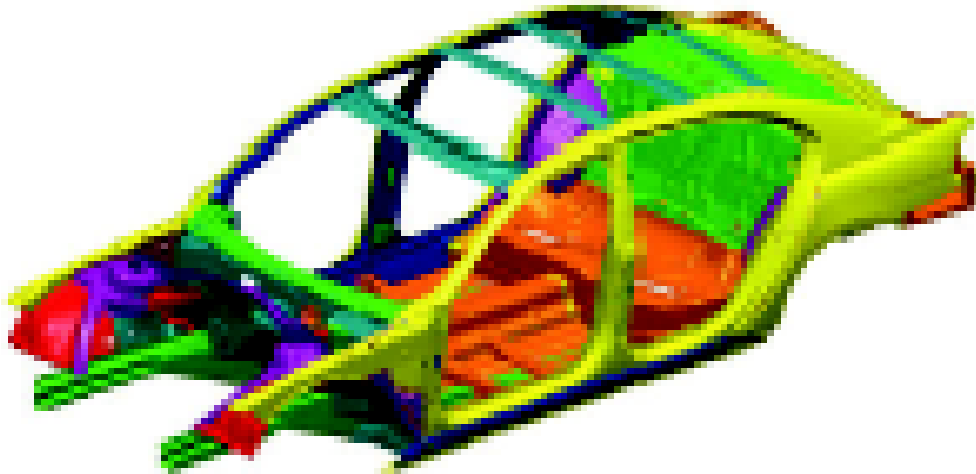
Optimising of production process

- Reduced number of spot welds
- Light joining techniques
- New manufacturing processes (e.g. hydroforming)

Materials used in a mid-sized car



Steel Unibody (BMW 7er Series)



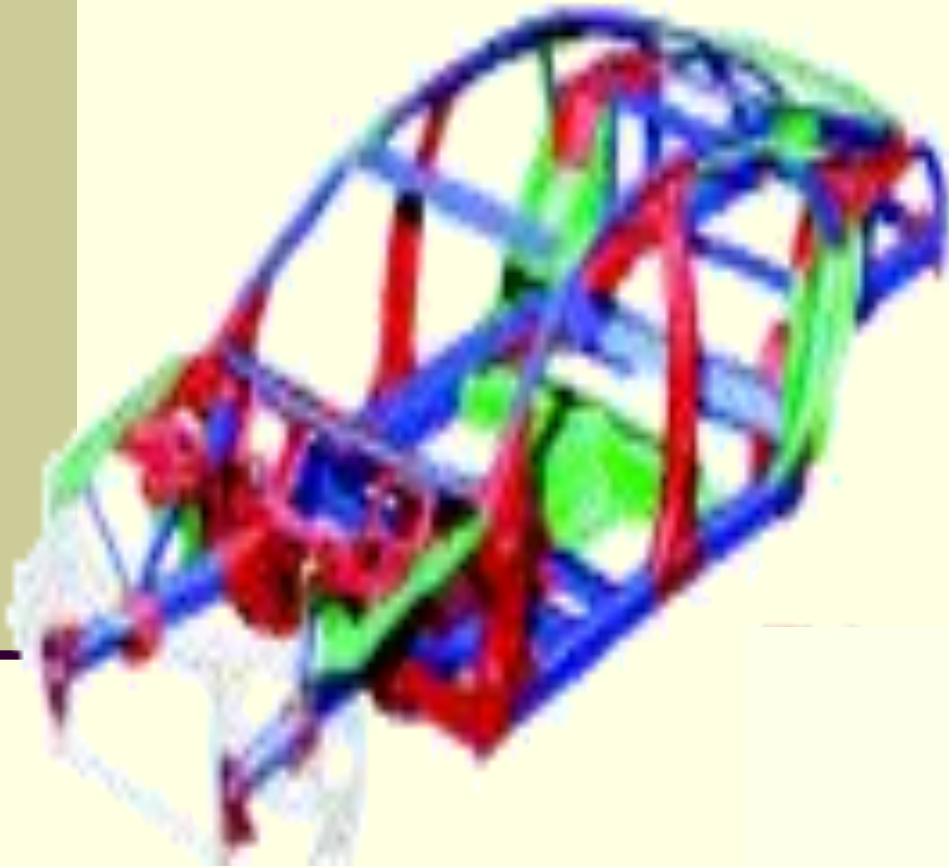
- DC06 (120 MPa)
- DC04140
- 25tE220
- 25tE300
- 25tE380
- 25tE420
- CP800
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

Multimaterial Unibody (Aston Martin Vanquish)



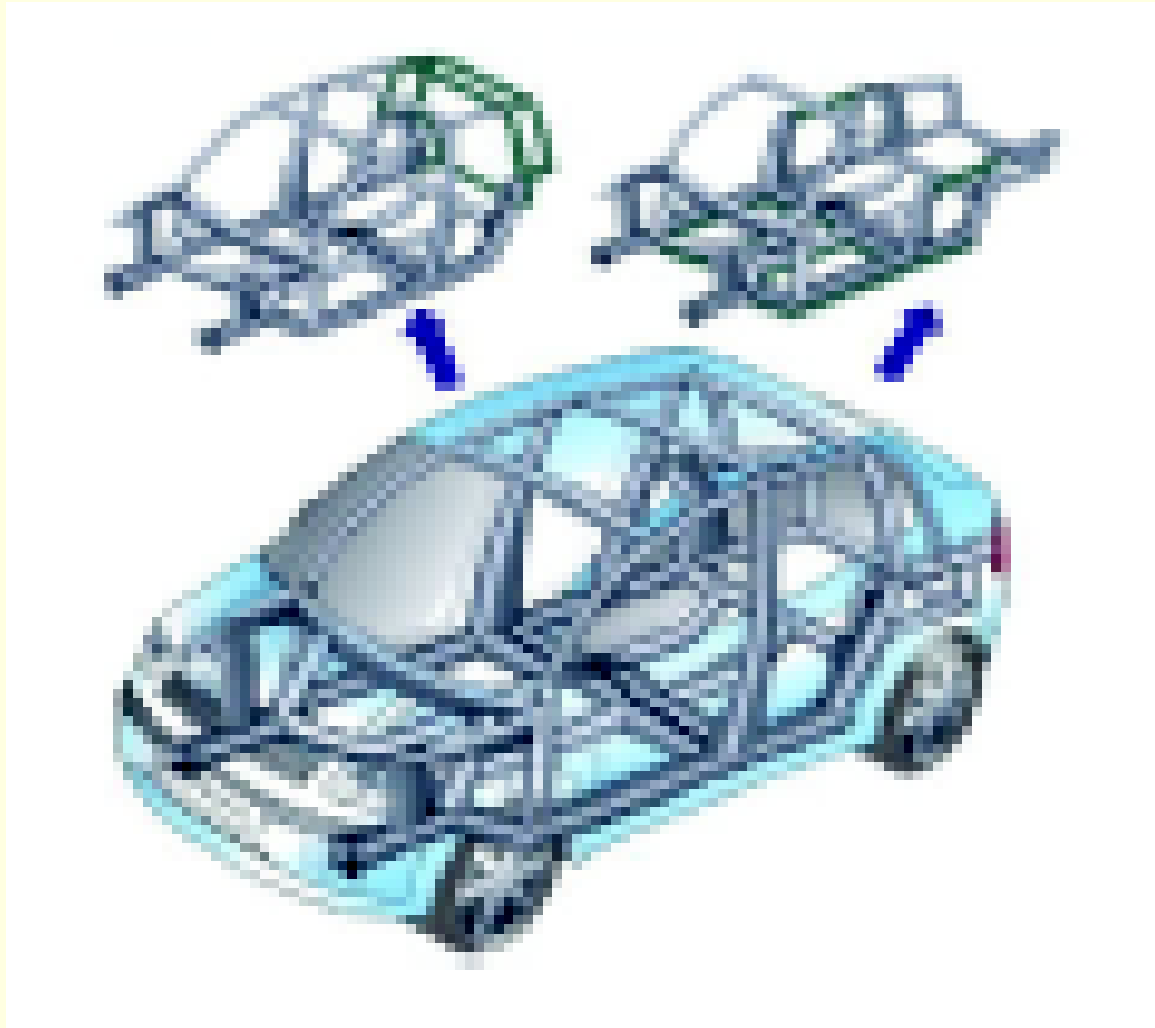
- Outer skin: hot worked aluminium sheet
- Centre tunnel, A-pillar and roof frame: CFRP
- Side sections, boot floor, crash structures: GRP

Aluminium Space Frame (Audi A8)



-  Cast Parts
-  Extruded profiles
-  Sheets

Steel Space Frame



Magnesium Space Frame (VW)

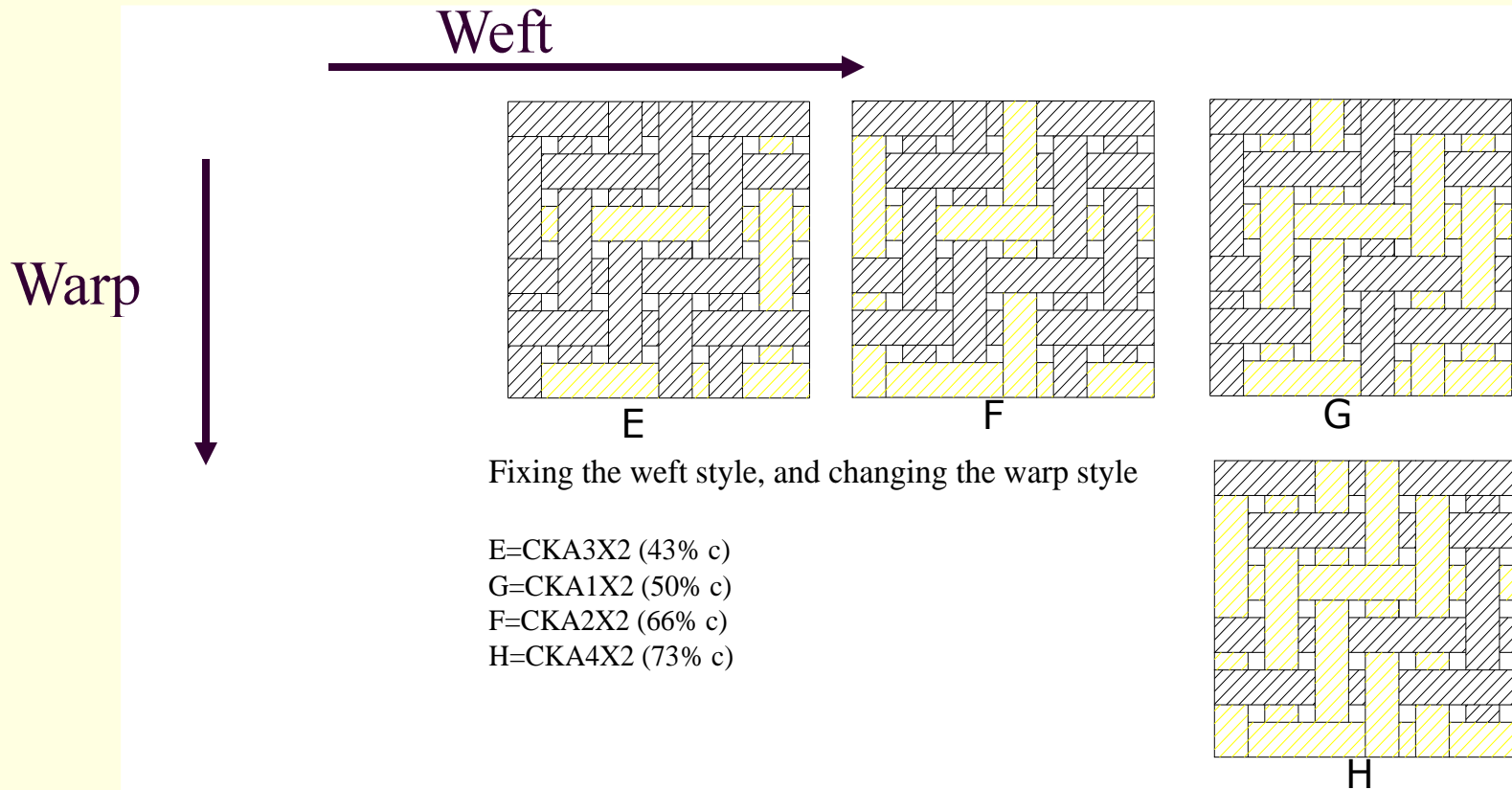


Composite materials



Hybrid Composites

Intraply carbon-kevlar hybrids



Application of composite materials



Application of different materials

- Aluminium engine mounts
- CFRP longitudinal member
- CFRP Cell

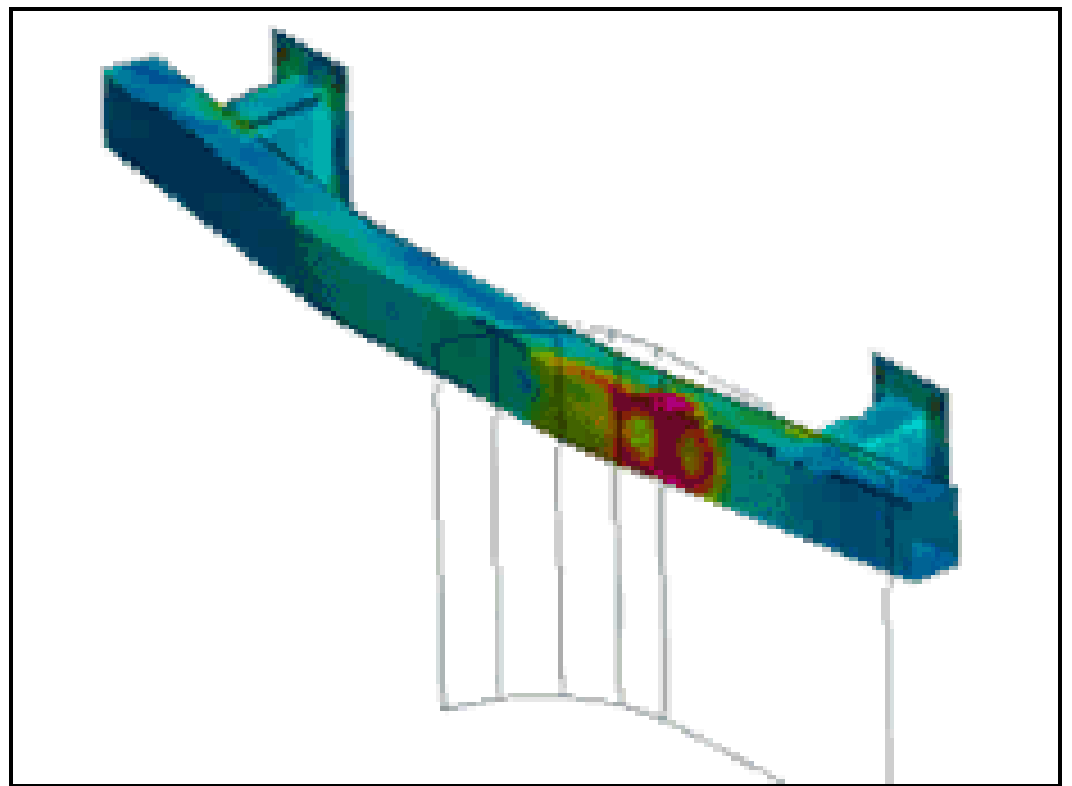


Structural analysis

- Accurate materials models are essential for the development of realistic deformation simulations



➤ **Computer modelling of bumper**



Structural testing



Deformation study of Audi A8 side member

Conclusions

- For optimum vehicle weight choice of materials, structures, manufacturing processes must be considered.
- The future is bright for composite materials.