Lightweight High Performance Materials for Car Body Structures

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Invited speaker

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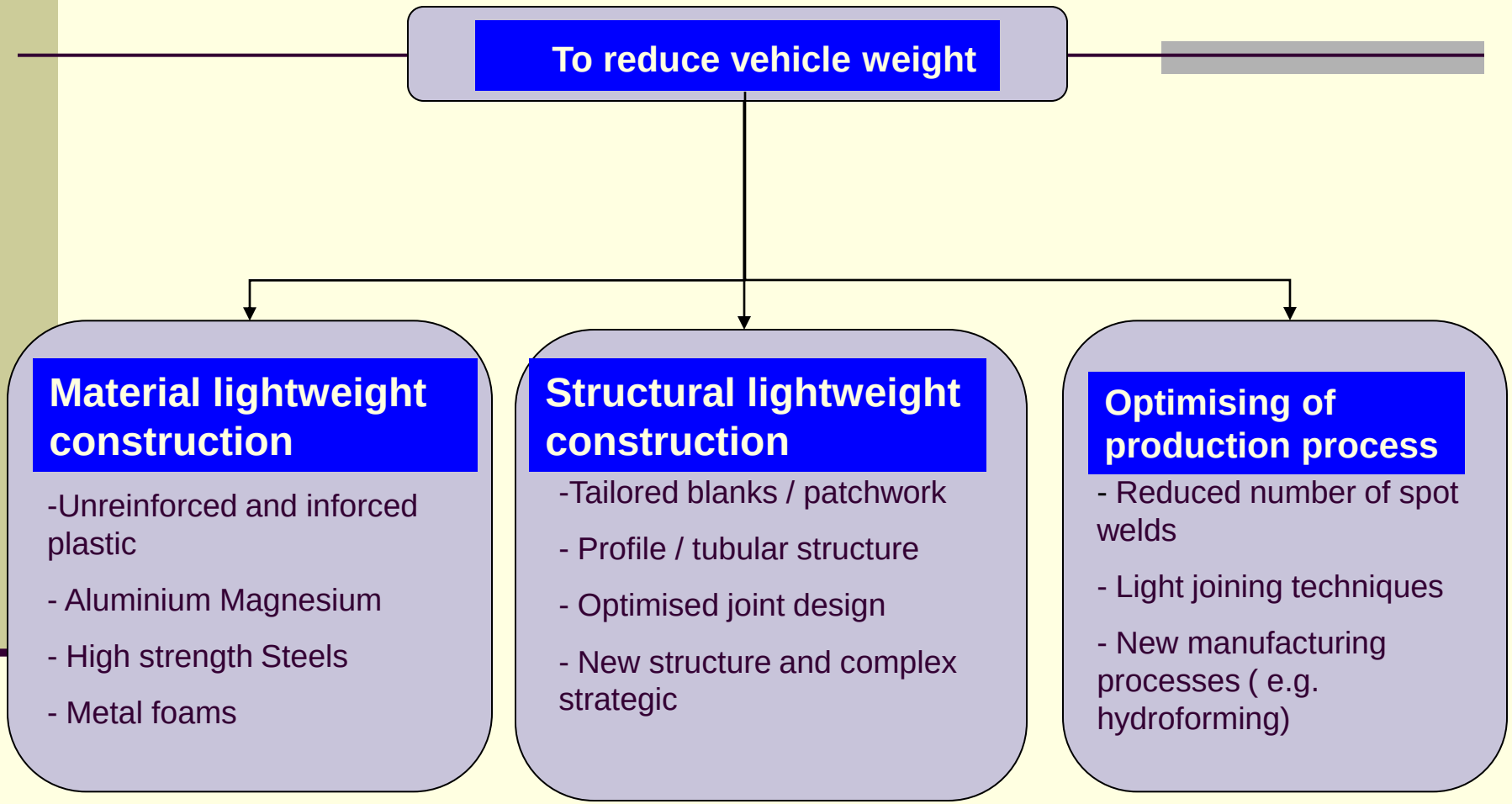
Presentation Outline

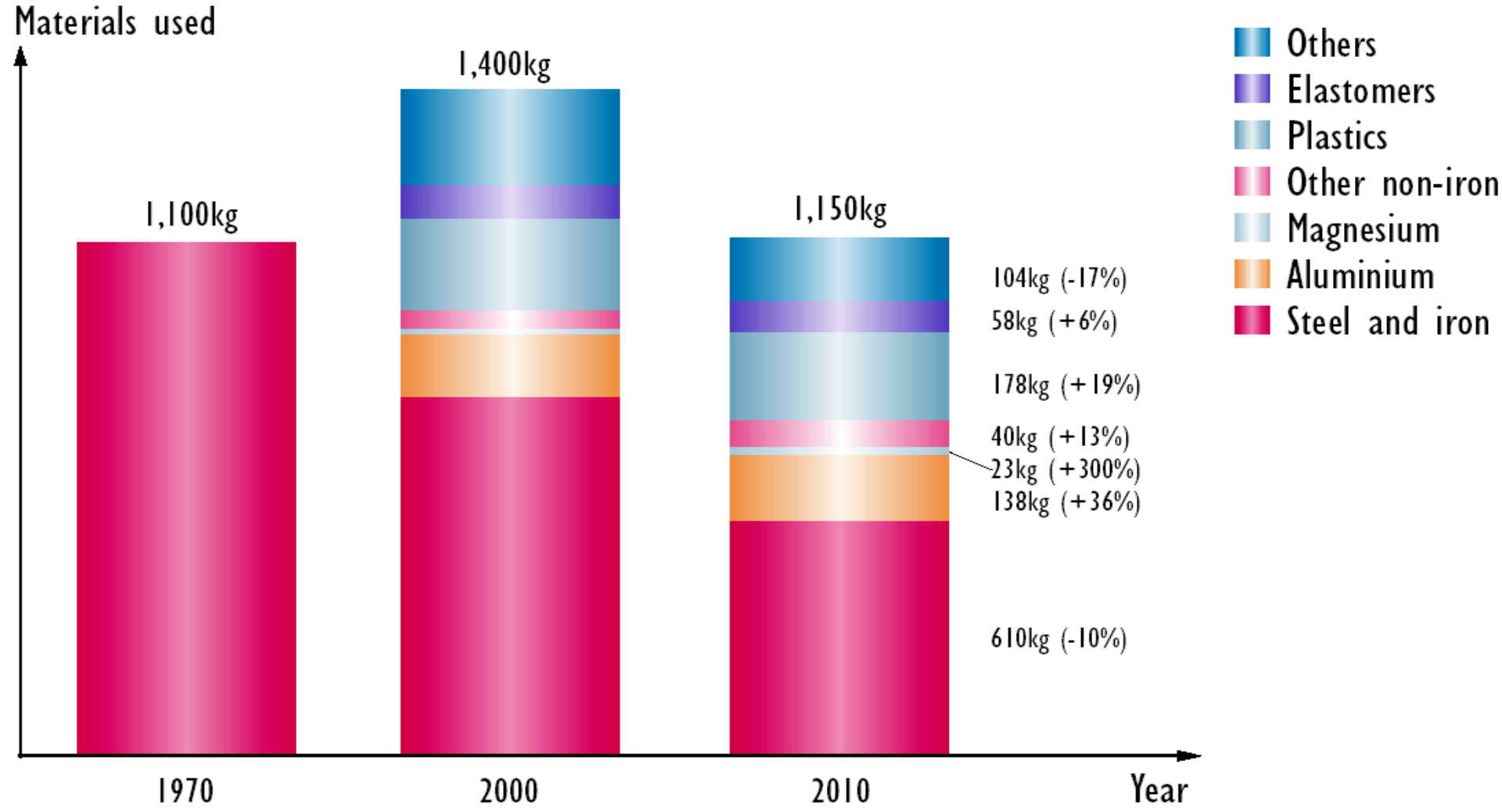
- Introduction
- Why lightweight high performance materials?
- Techniques to reduce car weight
- Existing materials and structures
- Potential for Fibre Composites
- Structural analysis
- Conclusion

Reasons for lightweight Materials

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


To reduce vehicle weight
Material lightweight construction
-Unreinforced and inforced 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

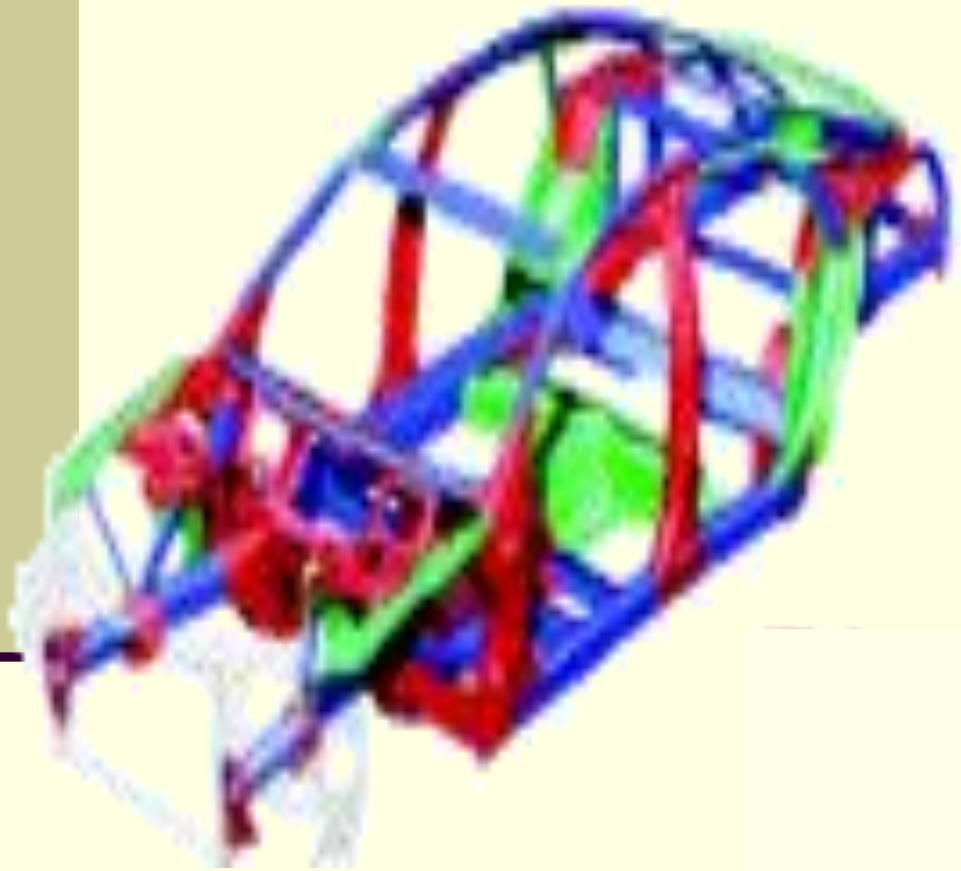


Steel Unibody (BMW 7er Series)

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)

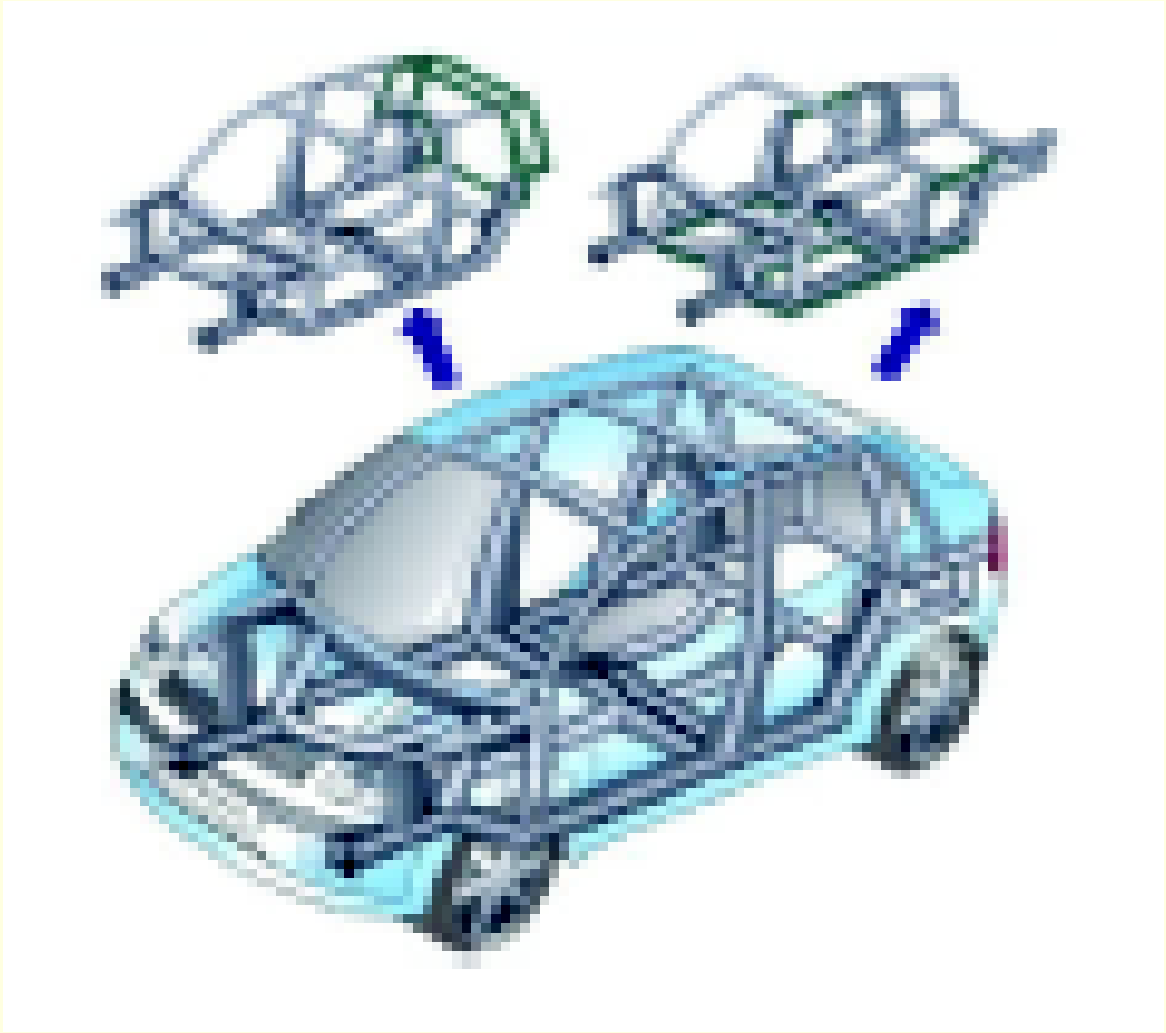


Cast Parts

Extruded profiles

Sheets

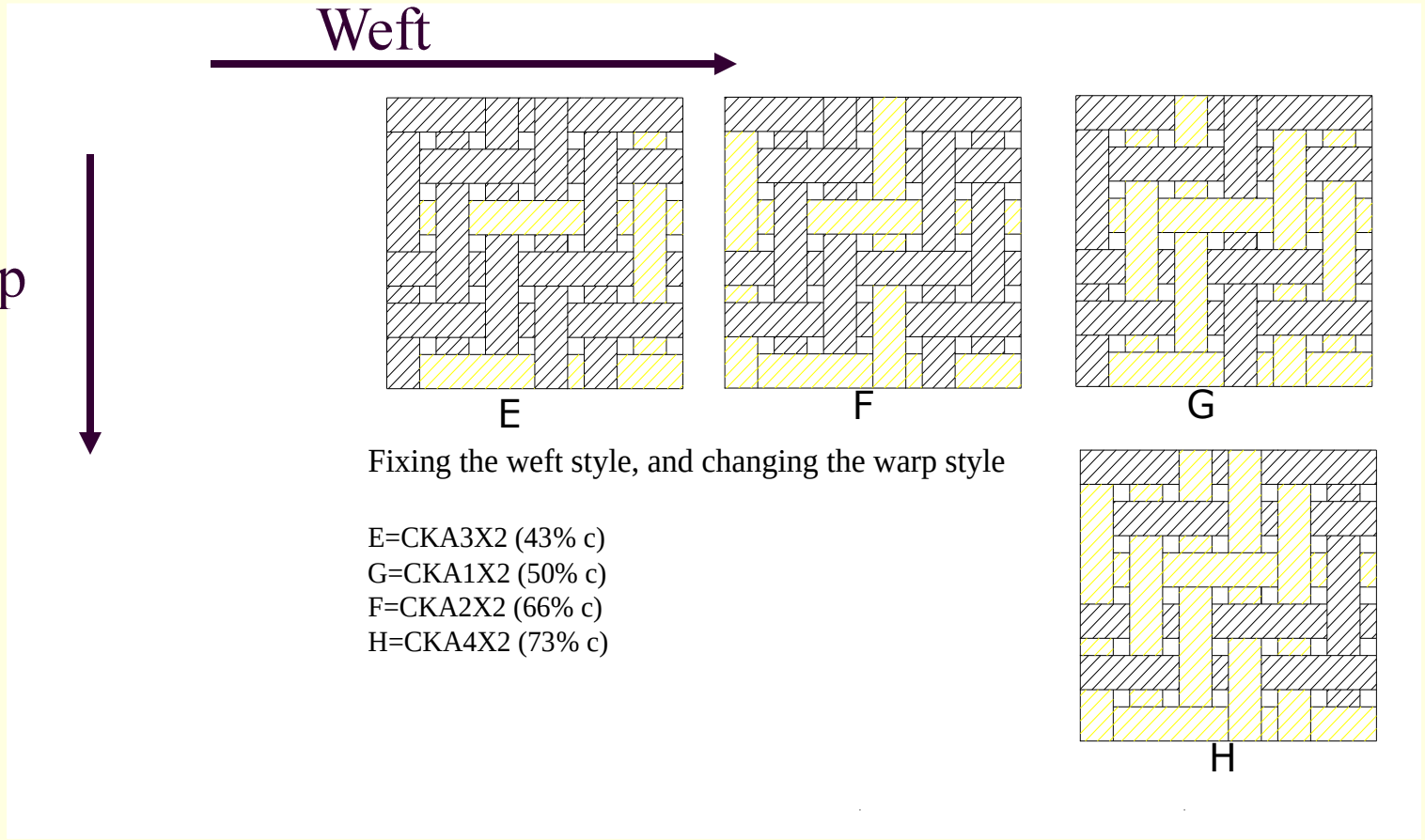
Steel Space Frame



Magnesium Space Frame (VW)

Composite materials

Hybrid Composites
Intraply carbon-kevlar hybrids



Fixing the weft style, and changing the warp style

E=CKA3X2 (43% c)
G=CKA1X2 (50% c)
F=CKA2X2 (66% c)
H=CKA4X2 (73% c)

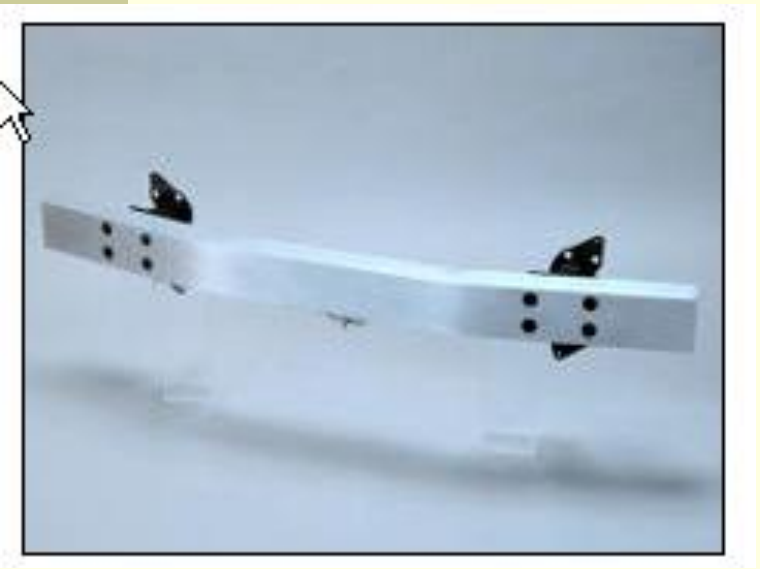
Application of composite materials

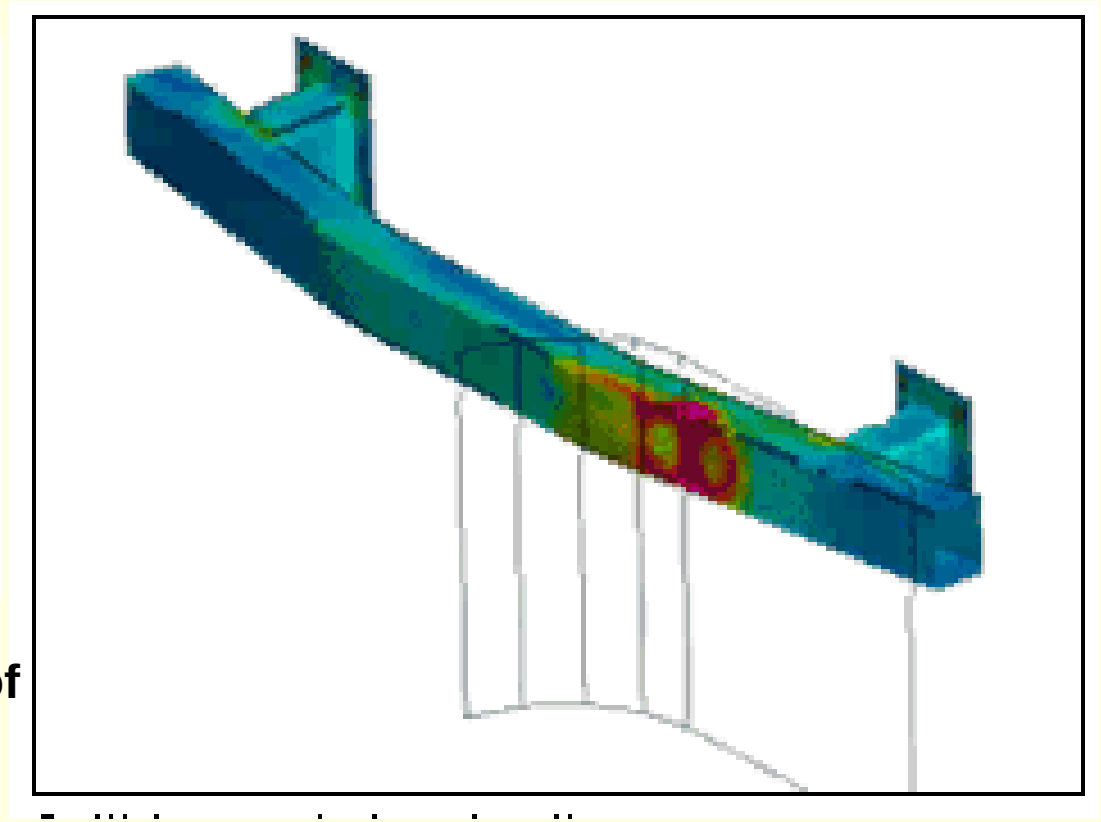
Application of different materials

- 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.