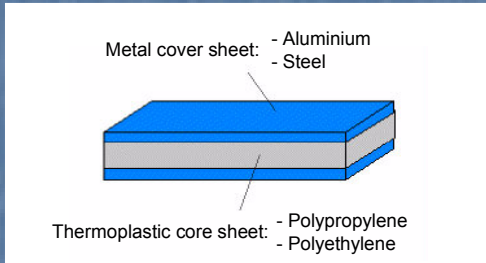


Influence of Temperature on the Springback Behaviour of Metal/Polymer-Laminates

M. Weiss, B.F. Rolfe, P.D. Hodgson
School of Engineering and Technology, Deakin University

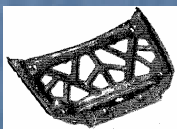
Introduction:

Demands for lower fuel consumption and pollutant emission provides a new impetus for the automobile industry to develop lightweight structures.



In Contrast to many other light weight solutions Steel/Polymer/Steel (SPS)-laminates can exhibit a high stiffness with low weight, and thus a high stiffness to weight ratio.

	Steel	SPS-Laminate
Thickness (mm)	0.9	0.22/0.56/0.22
Weight (Kg/m ²)	7.1	3.69
El. Bending Stiffness (N/mm)	10	10



Current hood inner

This makes them very suitable for non-loadbearing autobody parts like bonnets, boot lids or roofs.



Hood inner using Steel/polymer laminate - hood

Research Question:

Influence of core material properties on the forming and springback behaviour of Metal/Polymer laminates in bending

Methodology: Change of Core material properties by Testing at different process temperature

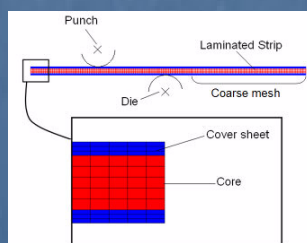
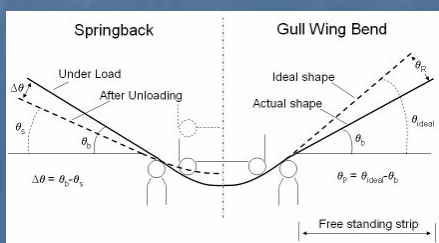
Material: • Aluminium/Polypropylene laminate

Experimental:

- Tensile and Shear tests
- Four-point bend tests

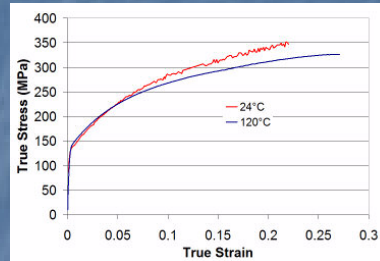
FEM:

- Four-point bend test

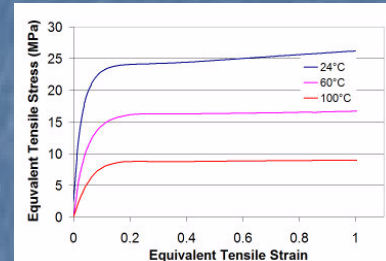


Results:

Tensile test (Cover sheet)

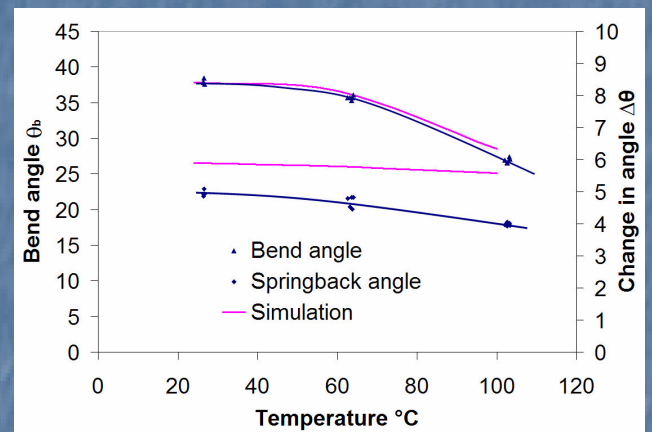


Shear test (Core layer)



- Minor influence of temperature on the cover sheet material properties
- Significant decrease in core material strength with increasing temperature

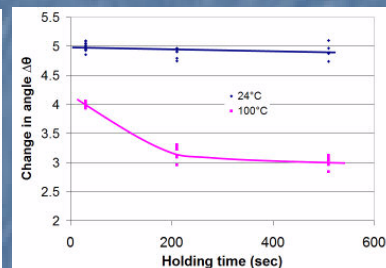
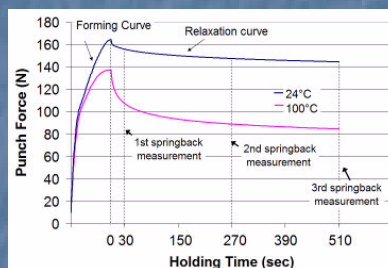
Four-point bend test



- Good prediction of the bend angle (i.e. the Gull Wing Bend)
- Bad Correlation with the experimental springback results

Discussion:

Bend relaxation test



- Core material properties have only a minor influence on springback
- The decreased springback is a temperature effect

Future Work:

- Bend forming tests on metal/polymer laminates with different Core materials
- Development of a Finite Element Model that accounts for creep and stress relaxation in the core layer at higher temperatures