Bending characteristics of carbon fabric-polymeric/metallic foam sandwich structures

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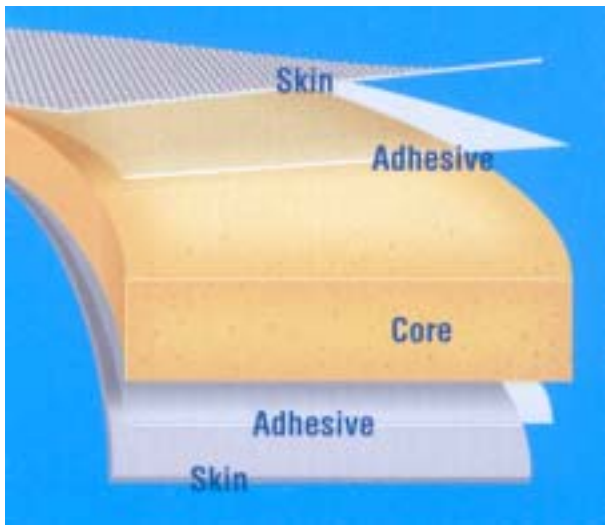
Sandwich Structures

- **To increase bending stiffness without sacrificing weight saving effect**

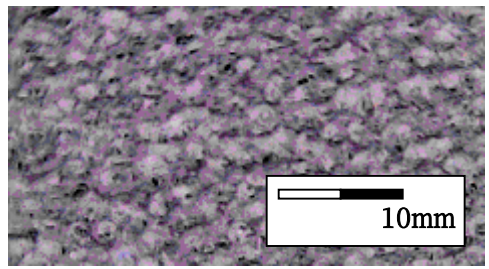
- Usage of Sandwich Structures

- **Skin**

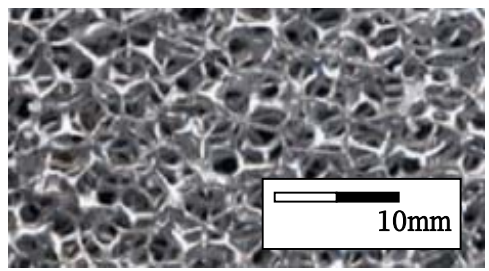
Carbon fabric/Epoxy



- **Core Material**



Polymeric foam
(PVC50, 70, 90, 110, PU)



Metallic foam
(Open cell type Aluminium)

Analyses Procedures

1. Thermoforming analyses (3-dimensional)

- **To determine crimp angle and peak to peak variation**

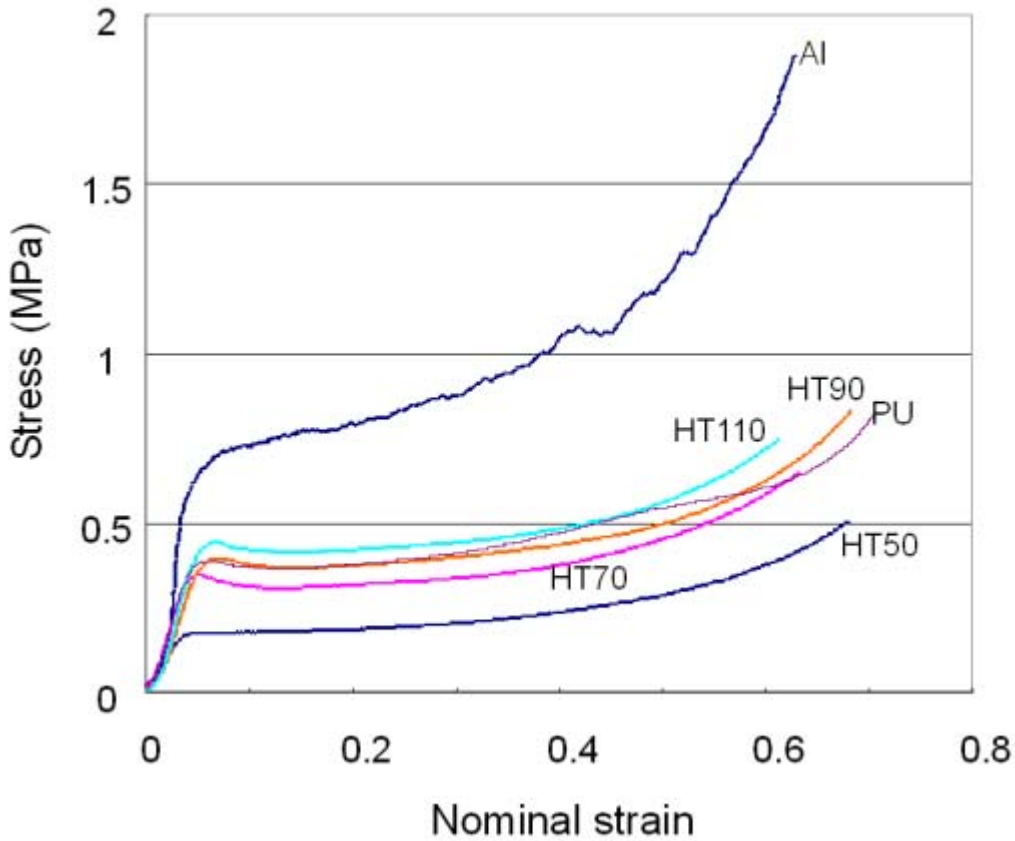
2. Tensile/compressive analyses (2-dimensional)

- **To determine in-plane tensile/compressive moduli of skins**

3. Bending analyses (3-dimensional)

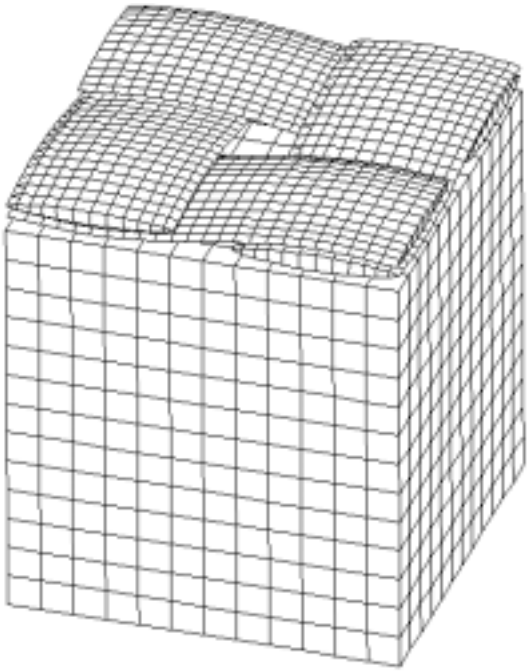
- **To characterise bending behaviours of sandwich structures**

Evaluation of Foam properties

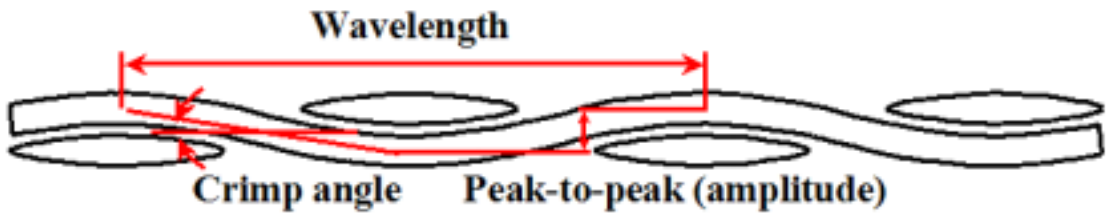


Nominal stress-strain curves of various foams in 125°C

FE Analyses 1 (Thermoforming Analyses)



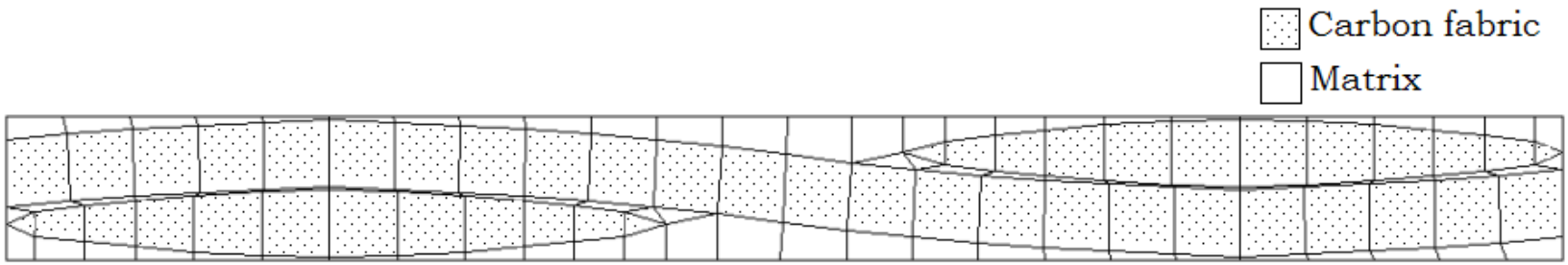
Forming condition: 3 atm (absolute), 125 °C

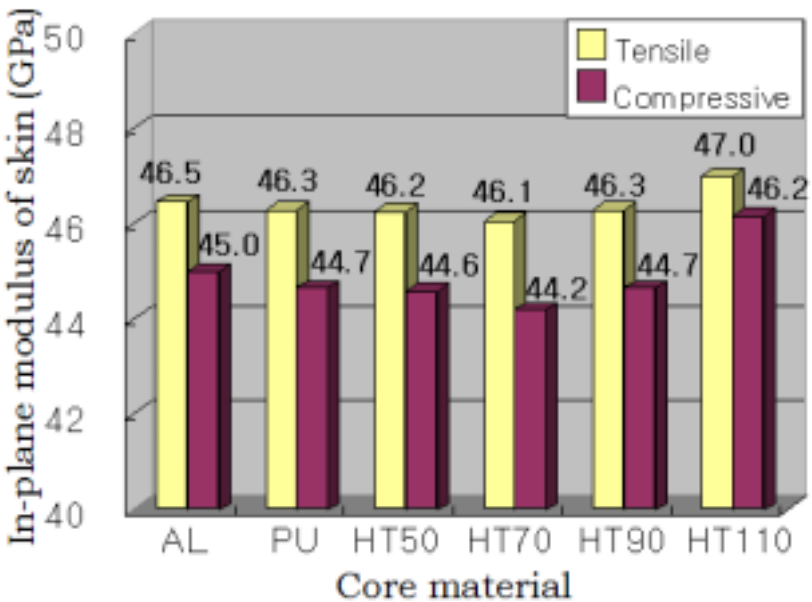


Representative unit volume model

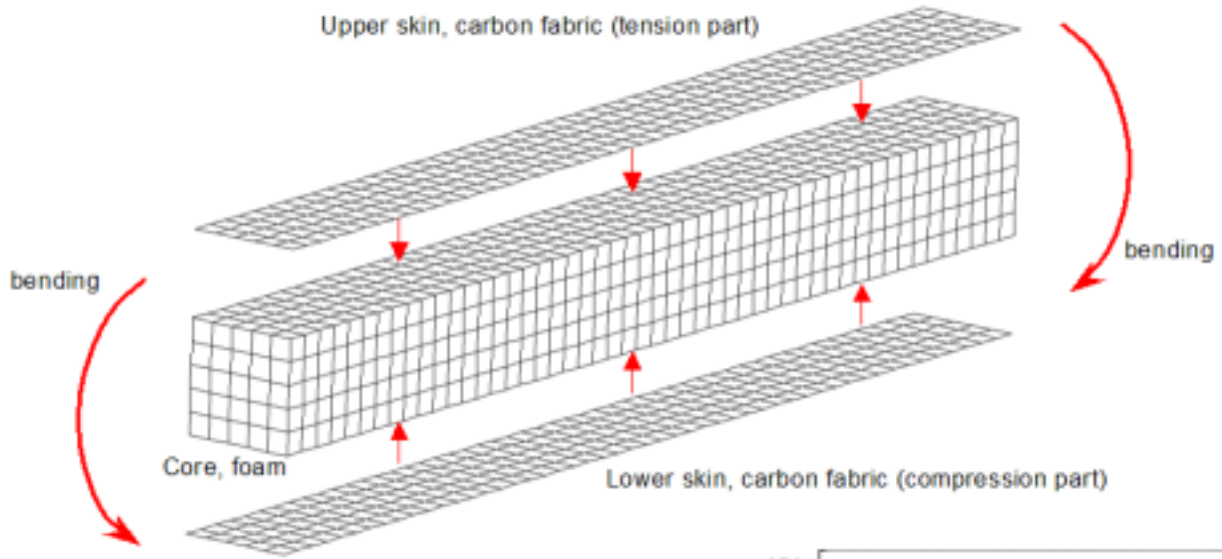
Foam	HT50	HT70	HT90	HT110	PU	Al
Crimp Angle (°)	5.85	6.26	6.03	5.79	6.01	5.62
Peak to peak (mm)	202.29	204.54	203.60	203.42	203.81	200.68

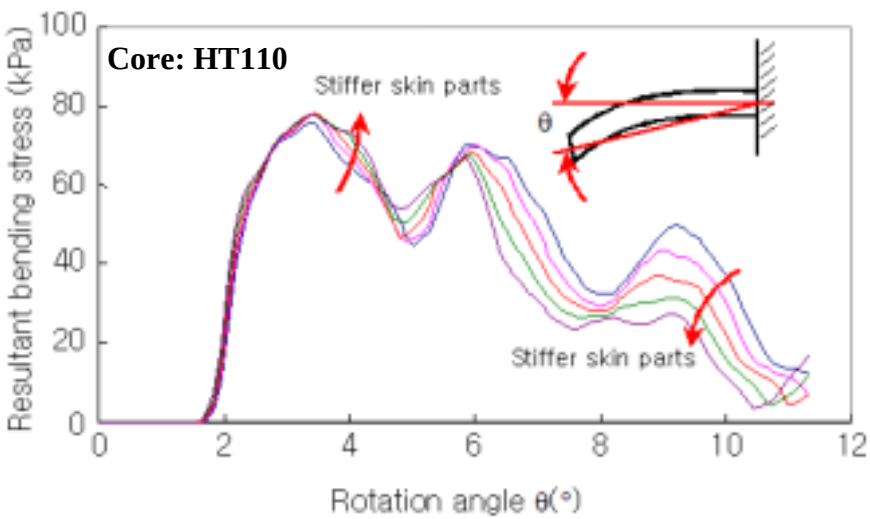
FE Analyses 2 (Tensile/compressive Analyses)

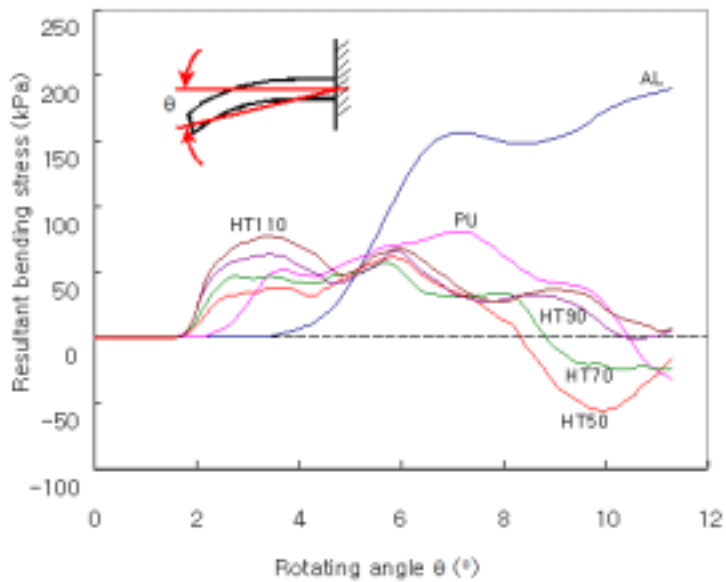




FE Analyses 3 (Bending Analyses)







Conclusions and Future Works

1. **A representative unit volume FE model was employed,**
2. **Thermoforming as well as two dimensional FE analyses were performed,**
3. **Bending analyses of sandwich structures were carried out,**
4. **There are no big merit for using higher moduli skin parts for sandwich structures from the crashworthiness point of view, and**
5. **Low density foam core sandwich structures showed negative resultant bending stress on the clamped region, whilst higher density foam did not allow compressive loading in the tensile area.**