



Bristol University work on reinforcement deformation

Kevin Potter

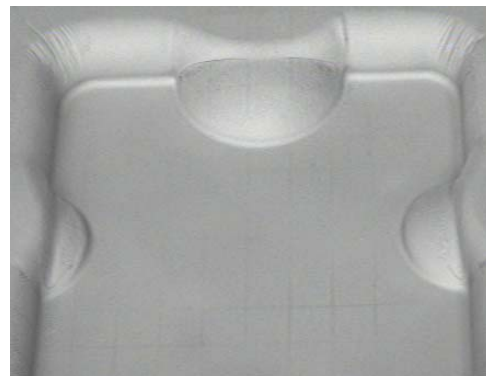
- ◆ **Work exclusively experimental, initiated to provide input data to Fibresim/Catia for a commercial partner**
- ◆ **Important to determine that materials behave as pin-jointed-net**
- ◆ **Bias extension testing used as this does not force PJN**
- ◆ **Partner's parts are generally single curvature with local areas of more complexity**
- ◆ **Shape forming trials have not used volumes of revolution**
- ◆ **Materials used: woven cloths, NCFs and +/-45 UD prepreg**
- ◆ **Dry woven cloth fits PJN perfectly up to fibre lock**
- ◆ **+/- 45 UD Prepreg fits PJN well enough for modelling at moderate strains, but out of plane buckling depends on specimen width and test rate, no fibre locking angle**
- ◆ **NCF shows major deviations from PJN under all impregnation Conditions**

Shape Forming

- ◆ Forming geometry was a 'square' block (20mm high) with different size cutouts in each side and various radii on edges
- ◆ Single diaphragm, elevated T, vacuum forming was used to form the shapes
- ◆ Materials used were +/- 45 UD prepreg and woven cloth prepreg
- ◆ UD prepreg gave better forming under all conditions, especially when the fibres were aligned with the tool edges
- ◆ With modification the UD prepreg gave far better forming
- ◆ The PJN has many benefits, but also imposes limitations



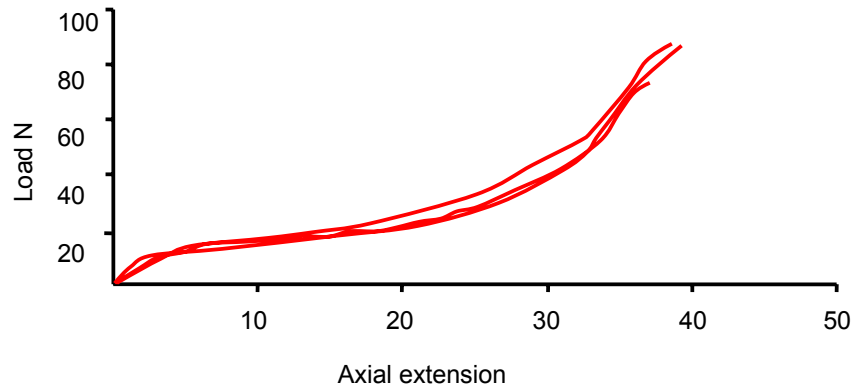
0/90/+/-45 modified UD prepreg



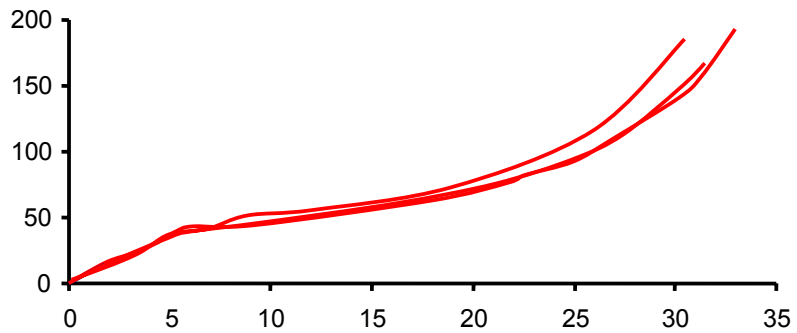
Single ply 5HS glass cloth prepreg

Reproducibility of bias extension testing on +/-45° UD Prepreg samples

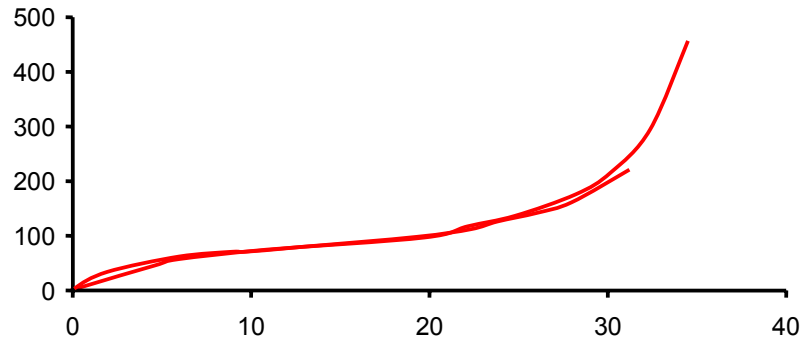
3cm wide, 60%/minute



6cm wide, 60%/minute



10cm wide, 60%/minute



Potter KD. Bias extension measurements on cross-plyed unidirectional prepreg. Composites Part A – Vol. 33 (1), January, 2002, 63-73.

Potter KD. Bias extension measurements on dry and preimpregnated non-crimp carbon fibre fabric. Proc. Int Conf for Manuf of Adv Composites. 27-28 Sept 2001. Belfast