University of BRISTOL
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ADVANCED COMPOSITES COLLABORATION FOR INNOVATION & SCIENCE

Investigation of Thickness Springback During Compaction of Uncured Prepregs

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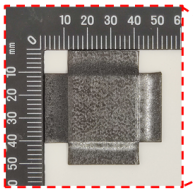
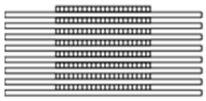
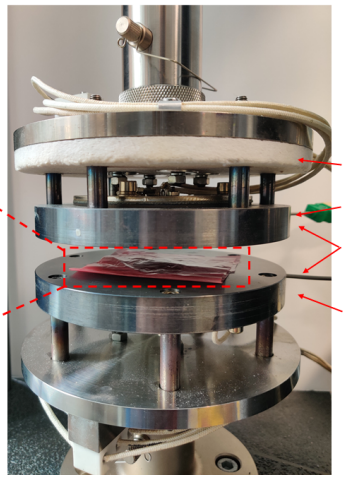
The growing demand for ever more cost and labour effective production of large, lightweight, and geometrically complex composite structures has led to the replacement of traditional manufacturing processes with automated processes such as Automated Tape Laying (ATL) and Automated Fibre Placement (AFP). During AFP processing, the deposited material undergoes cyclic mechanical loading and unloading induced by sequential passes of the compaction roller. The behaviour of the material under cyclic compaction becomes much more complex for material systems where hysteresis and permanent strain are an issue. Previous studies have also documented a springback effect in dry fibres, and it is expected that the spingback effect in other material systems will differ and result in further complexities. In this work, an investigation of the mechanical response to cyclic compressive loadings of toughened carbon/epoxy prepregs is undertaken.

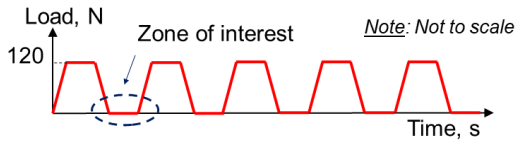
Materials and Methods

Hexcel® **IM7/8552**
(nominal CPT 0.125 mm)
Hexcel® **IMA/M21**
(nominal CPT 0.184 mm)





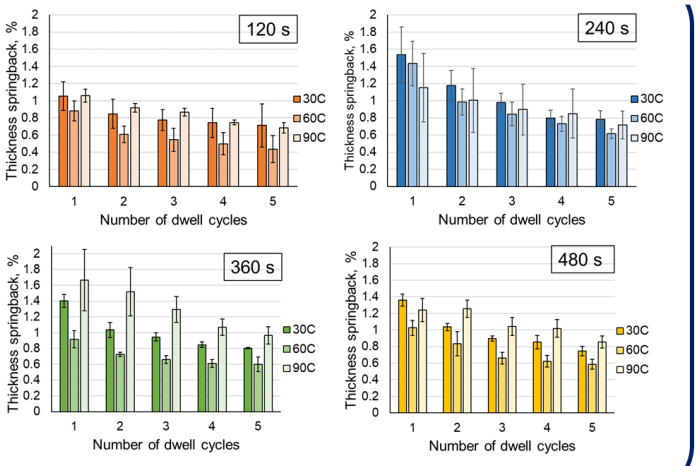




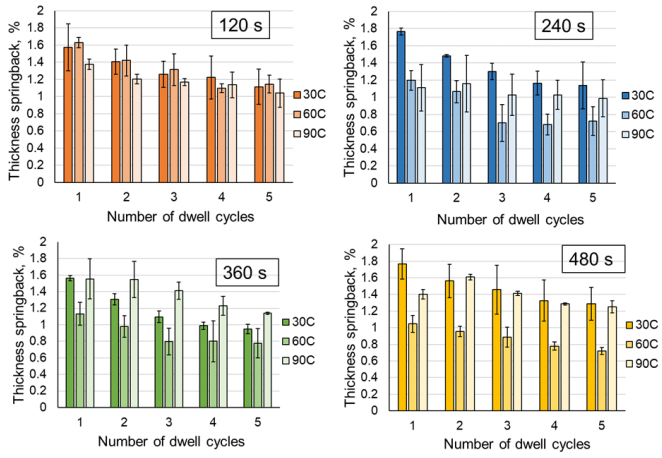
Loading dwell time
240s
Loading/unloading rate
45N/s
Unloading dwell time:
120s; 240s; 360s; 480s
Compaction temperature:
30°C; 60°C; 90°C

Results and Discussions

IM7/8552



IMA/M21



For both material systems, springback decreases with each successive cycle. However, the largest springback was observed at different compaction temperatures for each material system. The compaction temperature also affects the springback in these material systems. This information can be used to update current manufacturing practices, as well as develop numerical models, thus helping to drive improvements in the quality of the final part after manufacture