

Infusion of integrated structures with semi-cured elements

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Introduction:

Post cure joining operations and complex preform integration prior to resin infusion processes are two challenges facing manufactures as they can lead to delays in production and additional process verification. A multistage cure process is seen as having the potential to alleviate both issues. In this PhD project, a simple structure containing elements which were semi-cured prior to a final infusion and curing has been created for the purpose of investigating the effect of integrating these semi cured elements within composite structures and the subsequent effect on interfacial properties. Feasibility study results indicate that the addition of a semi-cured element slightly lowers the interfacial mode 1 fracture toughness. The research will develop over the coming years to close the performance gap and reduce manufacturing risk.

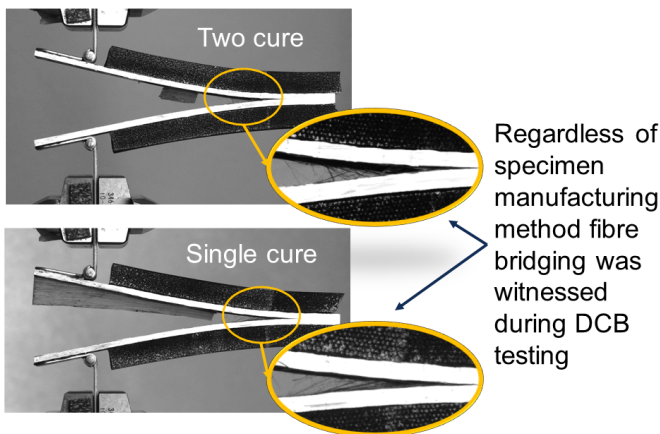
Manufacture & Testing

Two stage infusion & oven cure process:

- 1st cure @ 140°C for 180 min (semi cure) cure achieves $T_g \sim 86^\circ\text{C}$ and DoC ~ 0.7
- 2nd cure @ 180°C for 220 min (final cure) cure achieves $T_g \sim 165^\circ\text{C}$ and DoC ~ 1

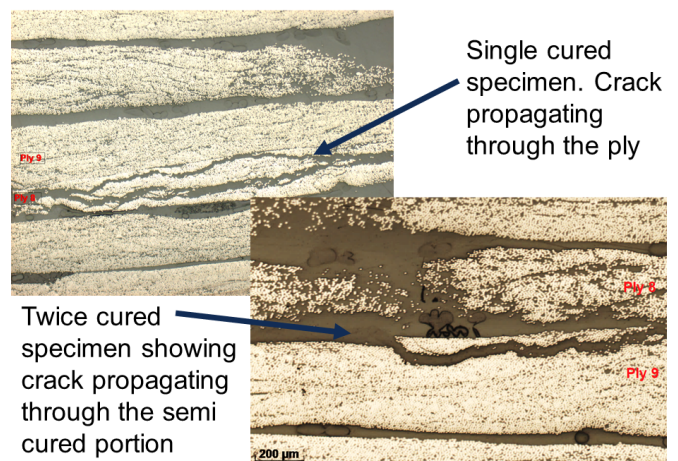
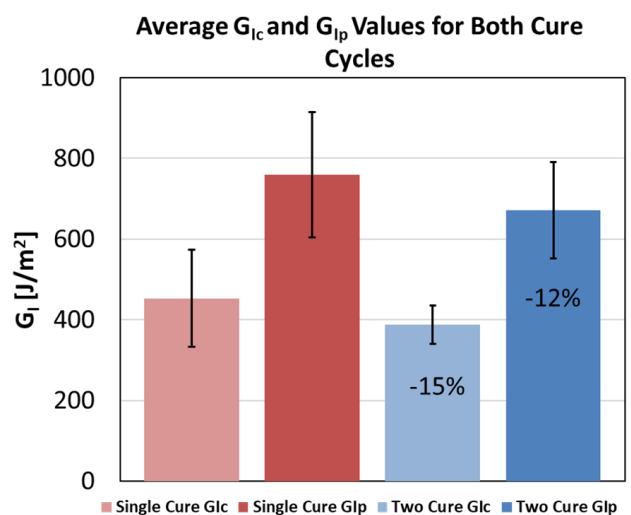
Baseline panel:

- Single infusion & cure @ 180 for 220 min DCB specimens machined from panels and tested.



Results

15% reduction in G_{Ic} and 12% reduction in G_{Iip} experienced in panels undergoing two cure process



Future Work:

1. Process window refinement:
 - Process modelling and optimisation
2. Creation of partially cured preforms
 - Handling and inspection
3. Partially cured preform integration
 - Tooling developments