CHARACTERIZATION OF IM7-TUFF 8552 COMPOSITES: INFLUENCE OF DEFECTS

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Background & Objective

Tailored universal Feedstock for Forming (TuFF) enables the creation of complex geometries
Applications in NASA struts involve replacing heavy titanium joints with composites

Defects in c-scans of TuFF IM7 8552 panels

Composites laminates with defects were scanned with MicroCT and digitally reconstructed

The defects are observed to be clumps of stray fibers that cause resin lean areas

Objective:

i. Quantify the effects of defects on material properties
ii. Revise process to reduce resin lean areas and clumps

Tension Testing

4-ply unidirectional TuFF IM7 8552 panels
Tension testing on ½ inch samples with strain gauges, with explosive failure modes

Impact of Resin Viscosity

The resin lean areas in thermosets (TS) not seen in thermoplastics (TP)
TP resins have a significantly higher viscosity than TS resins at processing temperatures, between 1000-2000 Pa*s

Higher resin viscosity allows for longer compaction time and increases the time provided for in-plane flow

Presence of defects still affect material properties despite being resin-filled

Alignment Quality Control

Shifts for producing TuFF were increased, but not the cleaning frequency, resulting in higher clump variation

Increasing the cleaning frequency to match the increase in production resulted in a decrease in clumps

Conclusions & Future Work

• The defects negatively affect the properties of TuFF IM7 8552 panels
• Higher resin viscosities allow for more in-plane flow and reduce the number of voids due to clumps
• Reducing voids improves modulus and decreases modulus variability
• Increasing frequency of alignment line maintenance has been effective at reducing the amount of clumps
• To achieve 100% property translation from continuous fiber, there cannot be any defects present
• Additional investigation is needed to reduce the number of clumps further

Acknowledgements

This material is based upon work supported by the National Aeronautics and Space Administration under Grant and Cooperative Agreement No. 80NSSC20M0164, issued through the Aeronautics Research Mission Directorate, Transformative Aeronautics Concepts Program, University Leadership Initiative.