Gas Detection for Cure Process Management of Composite Parts

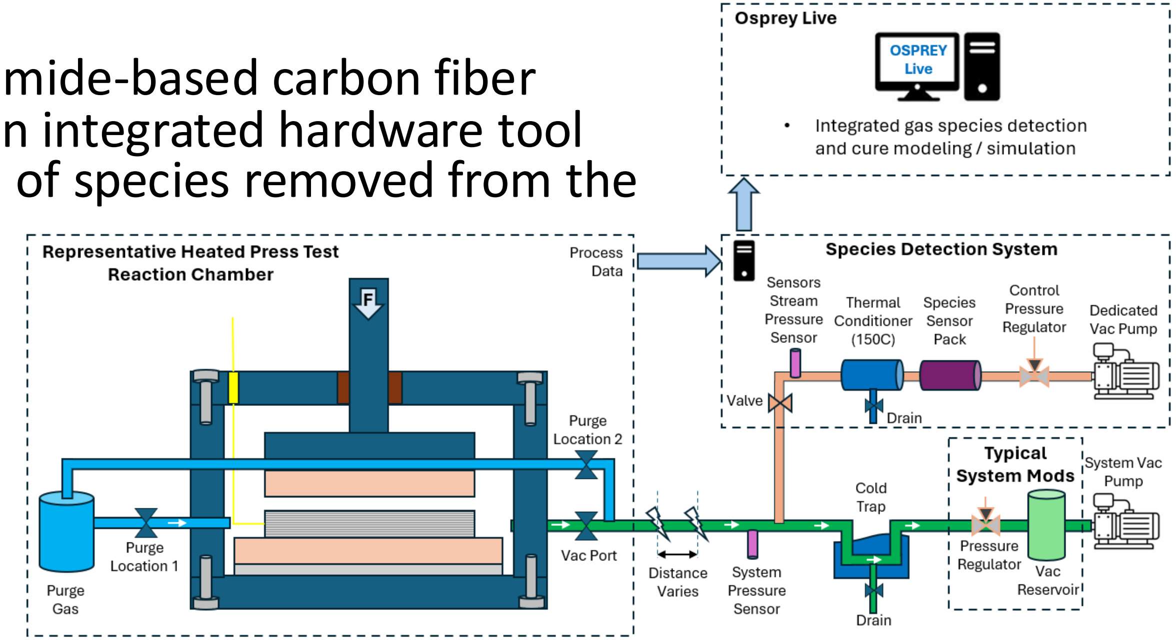
Background: Generation of volatiles can cause growth and lofting in laminates which must be managed to prevent porosity, distortion, wrinkling, or delamination. Polyimide processing consists of three phases; drying, imidization and removal of volatile by-products, and finally cure and crosslinking. Any measurements that can be made of system by-product evolution (species and total volume) can provide insight into when the process can advance to the next stage.

Goal: Improve processing capabilities and yield of polyimide-based carbon fiber reinforced polymers (CFRPs) through development of an integrated hardware tool that allows detection, identification, and quantification of species removed from the system in near real time.

Status: Direct to Phase II SBIR started June 2025.

Predicted Capability Improvements:

- Integrate hardware system
- Real time data collection and simulation



Thermal Process Simulation, Risk Assessment, Optimization, & Guidance Tools for Low Convection Applications

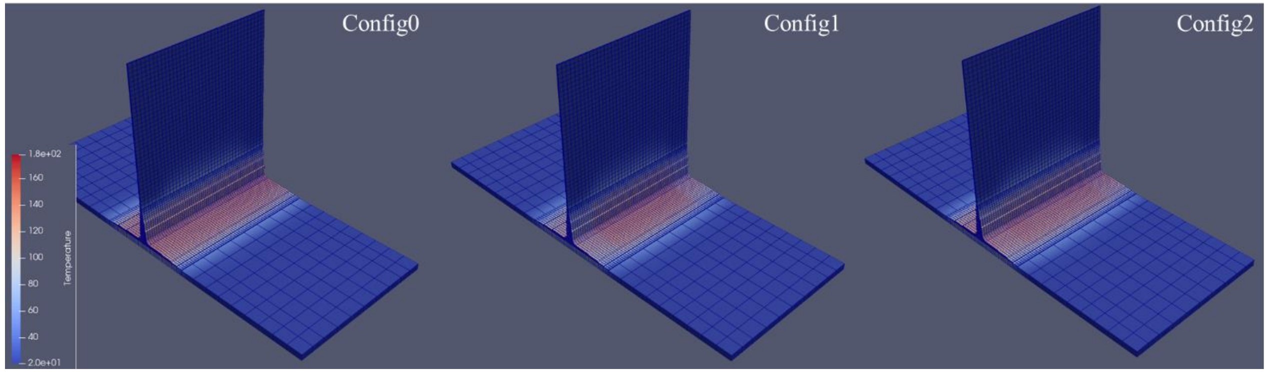
Background: Low convection heat transfer processes (heating blanket or OOA) have difficulty meeting thermal requirements in all locations. In particular, they are susceptible to local variations in temperature as a consequence of part geometry, heat blanket, bagging (insulation), and especially environment. Previous work in the field of repair has been done to model idealized geometries and predict local sensitivities to boundary conditions (HTC).

Goal: Develop a fast, standalone tool for low convection heat transfer process. Characterize materials and processes

Status: Direct to Phase II SBIR completed June 2024. Running in OSPREY Currently in Phase III in customer projects.

Capability Improvements:

- Fast app heat blanket design and optimization for manufacturing
- Better understanding of HTC impact
- Fast and accurate simulation, detailed in case study.
- N10 Breather and Heatcon Heat Blanket characterized



Increasing the Manufacturing Robustness of Complex Composite Geometries by Modeling the Process Variability due to the Human

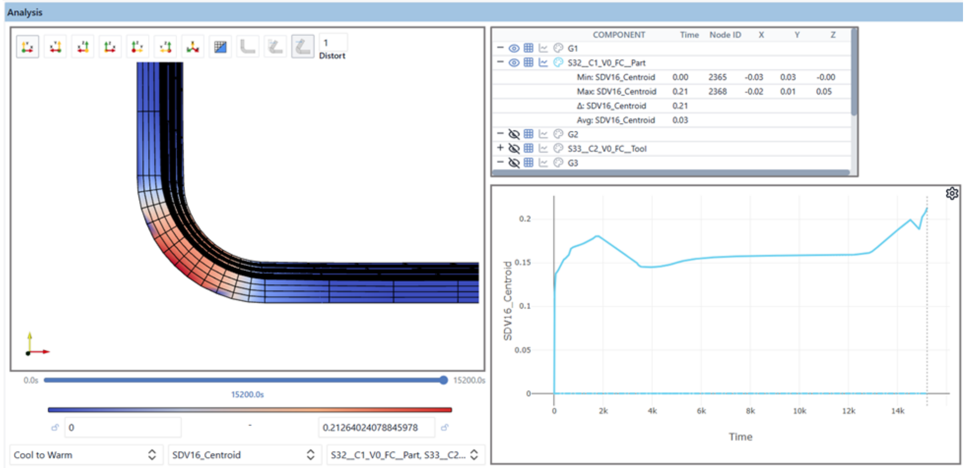
Background: Cure related defects such as porosity, wrinkling, and thickness variation are common issues. Influence of variability in the pre-cure manufacturing not well understood, this project seeks to characterize variability and its role in final part quality outcomes of interest.

Goal: Characterize and develop simulations for sources of variation in deposition, debulk, and bagging. Develop detailed simulations in COMPRO as well as a fast-running reduced order model to make simulation available to wide range of users.

Status: Phase II SBIR Completed July 2025. Running in OSPREY.

Capability Improvements:

- Fast app workflows developed for porosity and thickness variation
- Solvay 5320-1/IM7 characterized and available



Innovative Methods for Thermoplastic Composites on ATL/AFP

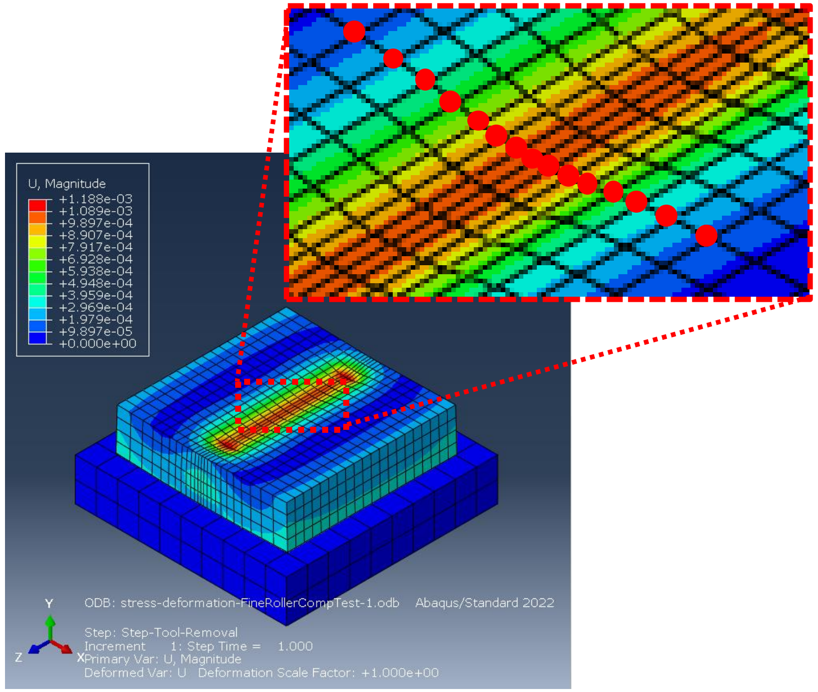
Background: AFP methods offer unique manufacturing benefits but are subject to defects during deposition, including weld quality issues. Deposition rates are slowed to improve part quality, leading to a longer processing time that can be optimized through simulation.

Goal: Improve AFP thermoplastic deposition rates by 30% or more with the same of better part quality (as measured by PID (distortion) using process simulation and optimization

Status: Phase II SBIR completed September 2025. Running in OSPREY

Capability Improvement:

- Fast app capabilities for AFP processes with weld quality and distortion



Process Simulation & Optimization for Thin-Ply Composites

Background: Thin ply parts are 5-10% flatter than the tool.

Goal: Develop process simulation for thin ply thermoset composites and thermoplastic composites in continuous compression molding processes to reduce distortion

Status: STTR Phase III began in October 2025. Phase IIE funding pending.

Capability Improvement:

- Fast app capabilities for curing and CCM processes for distortion