Additive Manufacturing of High Temperature Polymer Composites

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Introduction
Processing PAEK/CF polymers

• PAEK family: high performance thermoplastics act like metals
• Aid in weight reduction in aerospace industry
• CF addition : Improved stiffness, thermal and electrical conductivity
• Require high processing temperature

1) Traditional Manufacturing methods

2) Additive manufacturing PAEK/CF

Additive Manufacturing
Machine features and Material set-up

Research Objective
• Identify parameters influence fracture toughness
• Develop physic-based model to predict mechanical properties
• DOE and optimize processing parameters
• Identify multi scale effect of processing parameters on Fracture Toughness

Achievements : Multiscale Effects
Experimental Set Up
• 5 dog bone V type ASTM samples are made for each process condition.
• The tensile tests were performed using an Instron 4448 machine with a 10 kN loadcell capacity at a rate of 1 mm/min

Macro-scale: Performance

Micro-scale: Void Shape and Sizes

Roughness: 2) Microscopy

Achievements : Offline Design of Experiment (DOE)

Change G-code -> solve

Conclusion
Multiscale modeling -> design for any target industry
• Toughness → porosity, void shape and size
• Strength → porosity and bond strength
• Process(450,160,90< ) → ductile fracture with highest toughness

Reference

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