Improving the Printing Process of Carbon Fiber Manufacturing

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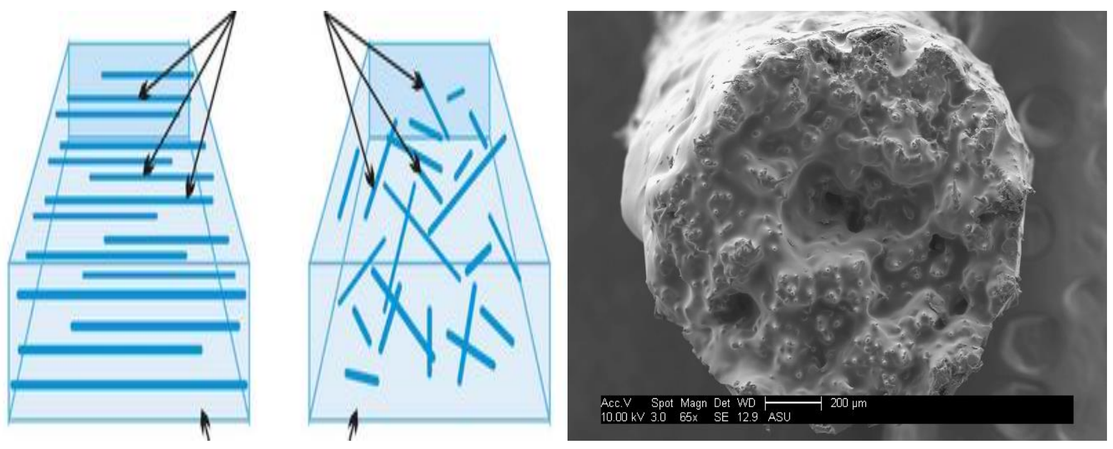
RESEARCH QUESTION: How can the extrusion of carbon fibers be leveraged to ensure nanofiber alignment in filament-based manufacturing techniques?

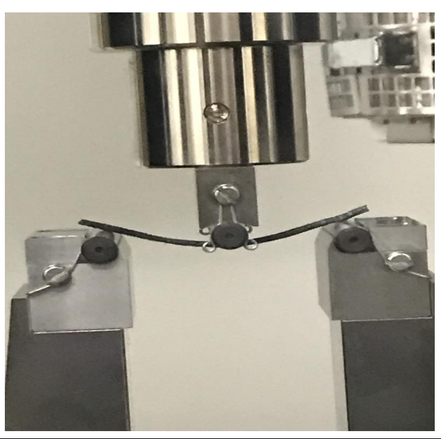
OBJECTIVE: We will leverage the fiber extrusion or spinning methods to

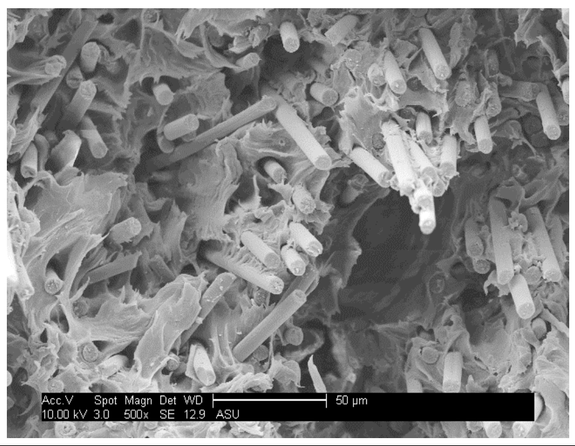
- Include no less than 45 vol% non-continuous carbon fillers (e.g., <5mm, aspect ratio >1000) in nylon filaments
- Post treat for carbon filler alignment within 15°
- Retain their morphology in 3D printing generated prepregs with a thickness larger than 0.5 mm
- Reinforce their thermal-mechanical durability and extend the lifetime

Broad Applications

Current manufacturing of extruding and used materials of nylons & nylon composites







Targeted composite structures and our composite filaments with carbon fiber alignment. We will use 3-point bending to study the composite mechanics

METHODS: We will develop a new manufacturing protocol for including high-concentration carbon fibers in anisotropic filaments for high-performance composite applications. The specific tasks include:

- Determining extrusion parameters
- Extrusion of carbon fibers within the above-mentioned parameters
- Post-print tensile and mechanical testing to verify the mechanical properties
- Determine usability as an alternative to current methods that are limited by the anisotropic nature of carbon fiber

PROGRESS AND OBSTICALS: I have been doing literature research regarding the composite-making. The current progress include:

- Specification of extrusion parameters
- Purchase of materials
- Literature summary of current state-of-the-art polymers

The **primary obstacle** is the difficulty in working in labs due to COVID19 and safety concerns. My research will be more efficiently done in the spring semester.

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