Exploring the Impact of Cutting Techniques on CNTy Composites

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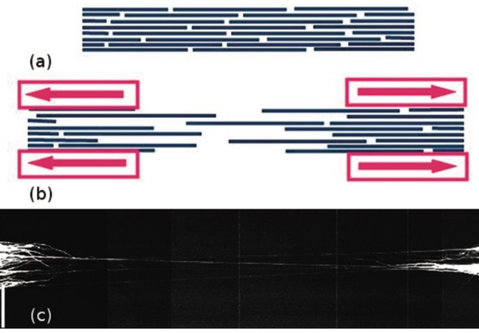
Motivation

The Future of Lightweight High-Strength Materials

- Potential to replace fiberglass and carbon fiber
- Aerospace applications are limitless
- By improving the cut quality, you improve the strength of the material

Problem: Traditional cutting methods damage the sample too much.

Manufacturing Methods



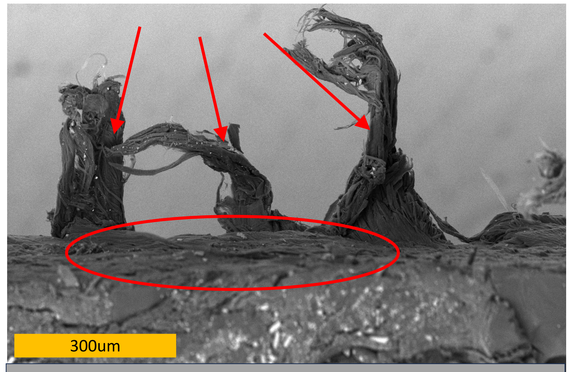
CNTy's tend to tear, not cut. See above.
Like animal yarn, CNTs are made of many individual fibers.

Cutting acts like using dull scissors on yarn.

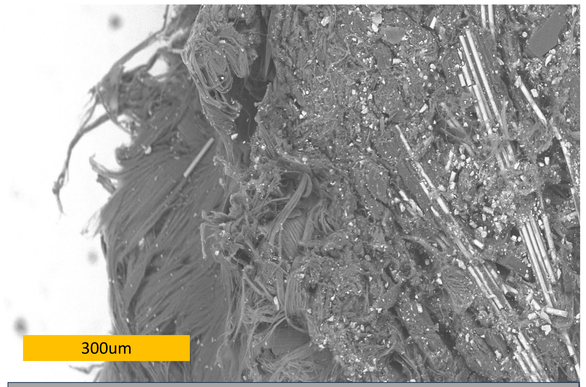
Used circular saw blades in Extec LabCut, which was the available machine.

Notable Factors:
- ✓ Diamond grit
- ✓ Durable
- ✓ Widely available
- ✓ Various grits – rough to fine

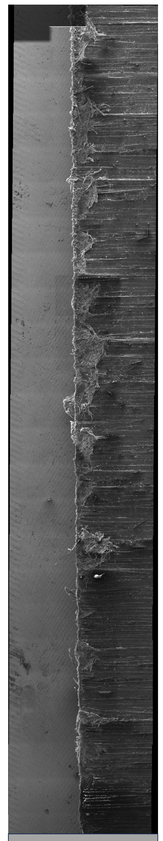
Experimental Progress



Finer Grit Blade Cut Edge



Rougher Grit Blade Cut Edge



Water Jet Cut

Finer Grit Blades have Displayed Better Properties

- Distinct fiber exposure – it is important for the cut edge to be clean
- Potential for reduced strength?
- Water Jet cut has most obvious cracks

Blade Types	Desirable Cut Characteristics			Score
	No cracks	Clean/Untangled	No Delamination	
Finest	1	1	1	3
Medium	1	0	1	2
Roughest	1	0	0	1
Waterjet	0	0	0	0

Potential Impacts

Better Cuts = Less Material Waste = Saving Money

- CNTy composites are very expensive to make so if you ruin it by applying it (rivets, edging, etc) then you waste money
- Decreased processing times because of a faster post-processing time (one step vs multi-step), which also results in saving money
- Aerospace applications cost less, are more effective, and increased cut quality reduces need to change aerospace applications

Can We Drill?

Since this research helps us with cutting, its possible that this knowledge will aid us in other types of material modifications, like drilling or riveting.

Drilling and riveting are important fastening techniques, we need to use this cutting information to determine the best method for them.

References

Scan this QR code to access the Google Doc containing all references