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Mechanical Sieving of Carbon-Fibre/PEEK Prepreg Trim Waste and its Influence on Compression Moulded Panel Properties

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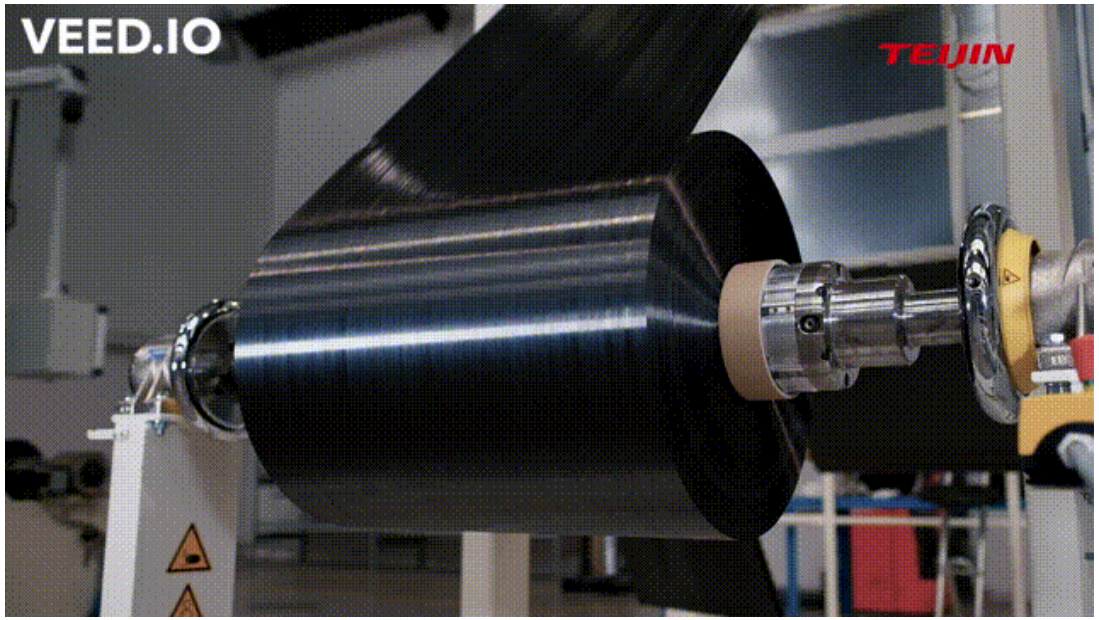
Tape Edge Trim (TET) Waste

- Non-uniform prepreg edges slit and chopped
- Chopping facilitates handling and reduces process interruption
- Waste rate estimated at 4.5 % to 5.4 % based on 12 in. rolls



Video source https://www.youtube.com/watch?v=VYtRInRLh1U.Converted to GIF using VEED.io

Tenax®-E TPUD PEEK-HTS45

Tape Edge Trim (TET) Waste

CARBON FIBERS | THERMOPLASTICS

Published 12/26/2022

Inside Teijin's thermoplastic tape expansion

Teijin is qualifying its second thermoplastic tape line in Heinsberg, Germany, that will significantly expand the company's presence in this material segment. #workinprogress

JEFF SLOAN
Editor-in-Chief, *CompositesWorld*

notes. The total capacity of the line varies by the areal weight of the material being produced, but ter Steeg reports that the system, at maximum throughput and maximum areal weight, can produce up to 320 metric tons per annum.

How many production lines & materials exist globally?

TEIJIN
Teijin Carbon America, Inc.
PEKK

HEXCEL
PEEK

SOLVAY
LM PAEK

MITSUBISHI CHEMICAL GROUP
PPS

PEI

TORAY
Toray Advanced Composites

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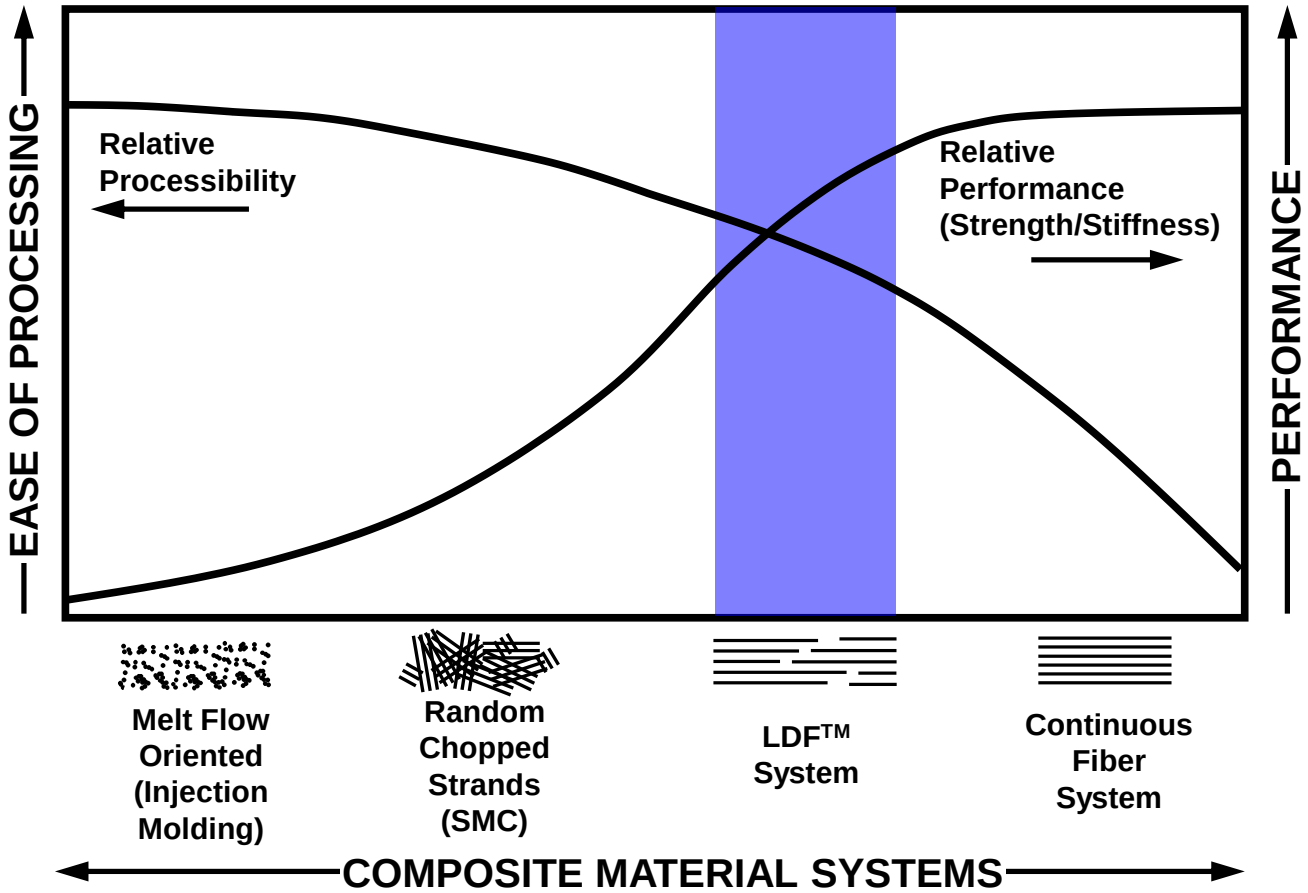
Strand-based Compression Moulding Compounds



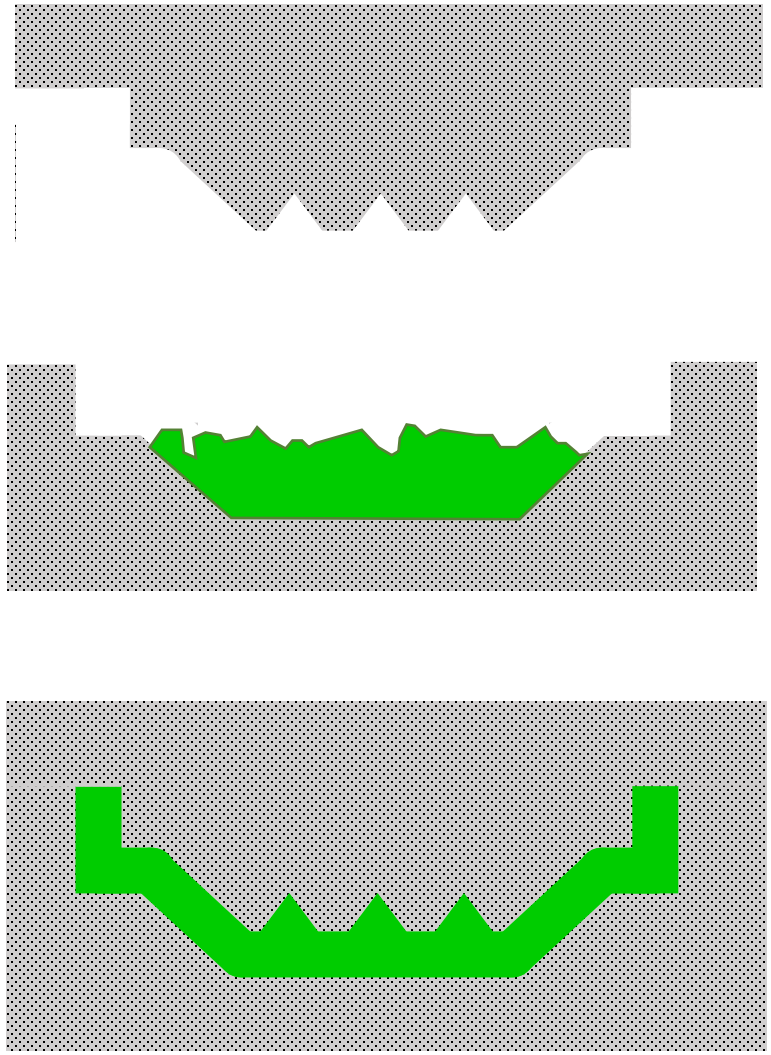
Smith (2021). DOI: 10.13140/RG.2.2.31101.44002

Control Arm
Feraboli et al. (2011)

Complex Demonstrator
Greene (2014)

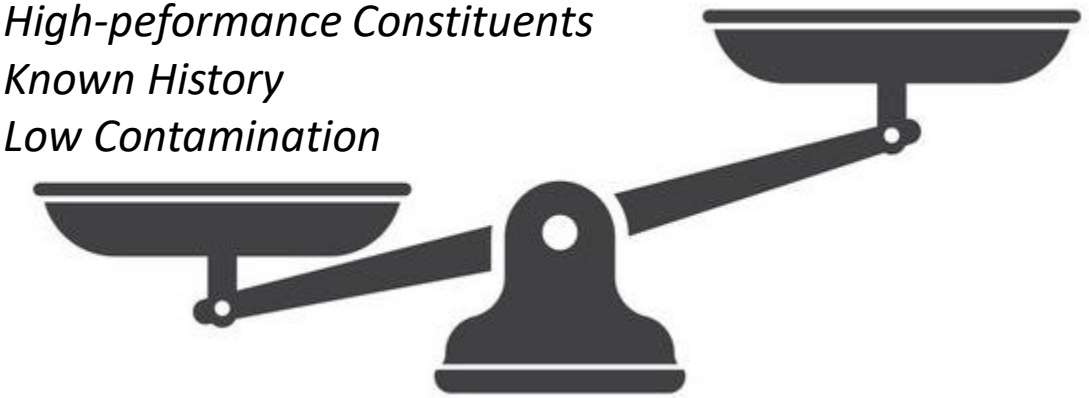
Complex Demonstrator
Greene (2014)

Challenges of Direct TET Compression Moulding



- *Low Energy Process*
- *High-peformance Constituents*
- *Known History*
- *Low Contamination*

- *Variable Strand Geometry*
- *Unknown Resin\Fibre Content*
- *Uncertain Production Volume*



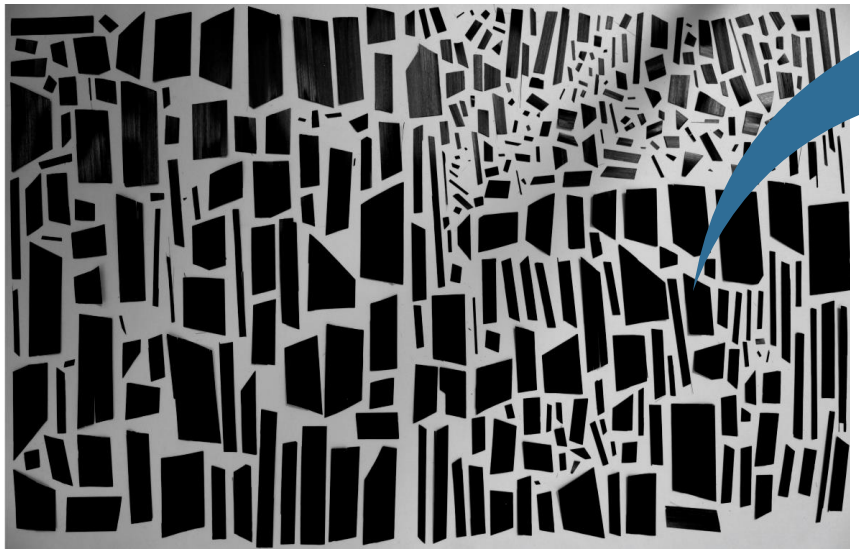
Objectives

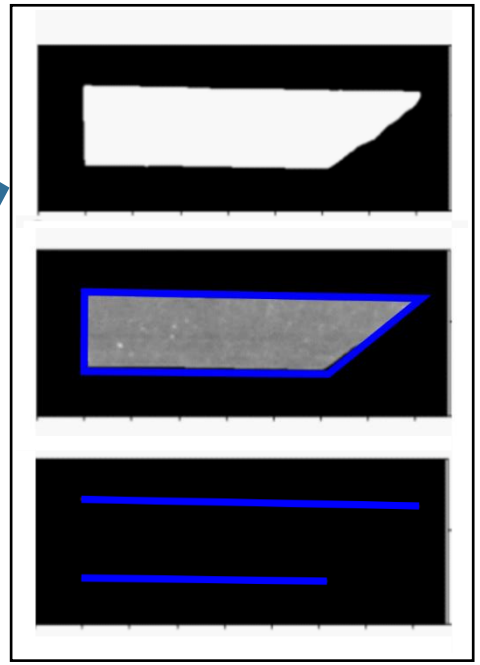
- Characterize strand geometry
- Perform mechanical sieving to reduce TET variability
- Manufacture panels from sorted and unsorted TET
- Measure resulting panel thickness and warpage
- Evaluate flexural properties

Image Analysis Tool

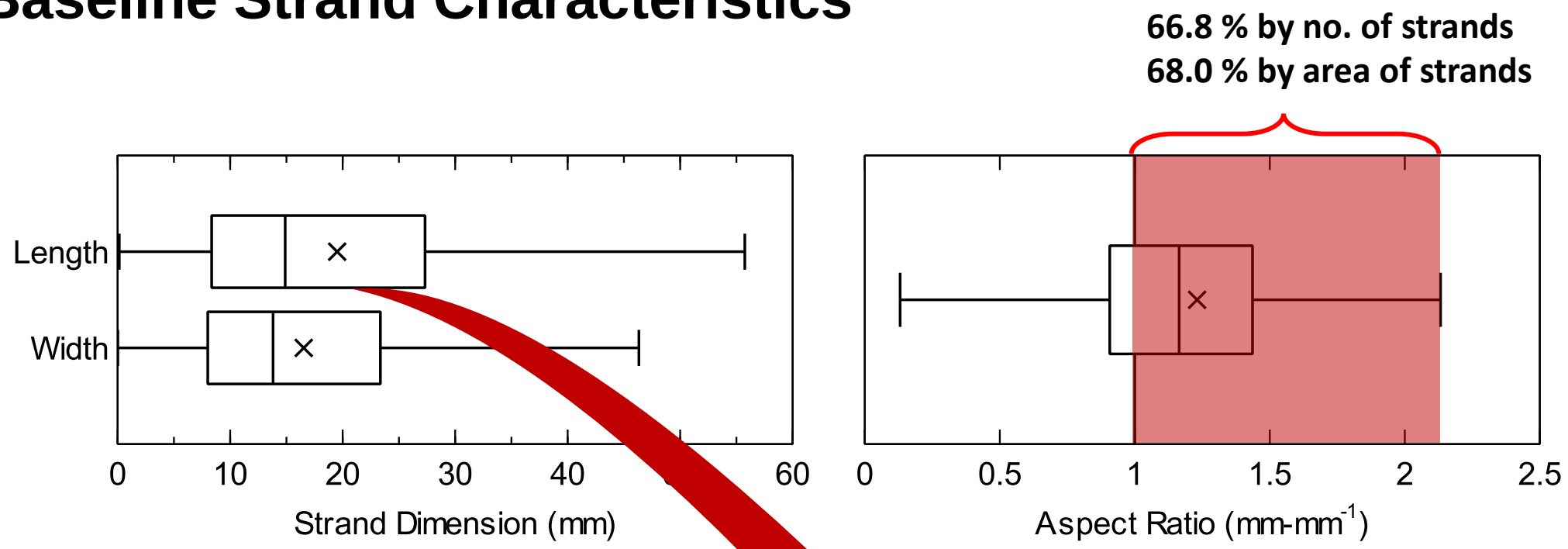
Python Code

- Length
- Width
- Area
- Aspect Ratio



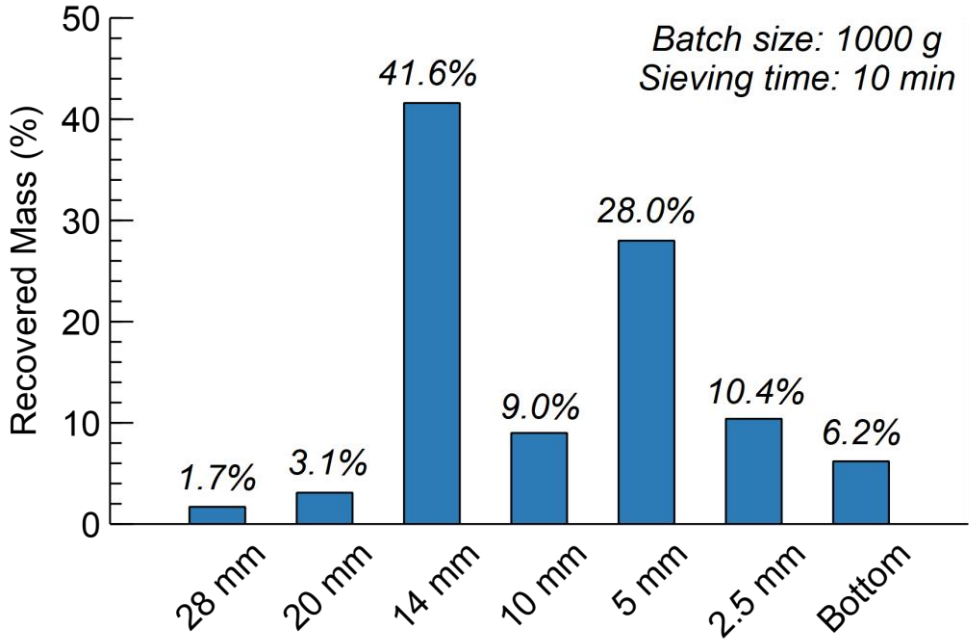


Baseline Strand Characteristics



	Mean, "x"	Median, "	IQR (50 %)	Min	Max
Length	19.5 mm	14.9 mm	8.4 – 27.3 mm	0.1 mm	55.8 mm
Width	16.5 mm	13.8 mm	8.0 – 23.4 mm	0.0 mm	46.4 mm
Aspect Ratio	1.23	1.16	0.91 – 1.44	0.11	2.23

Mechanical Sieving



20 mm

14 mm

5 mm

2.5 mm

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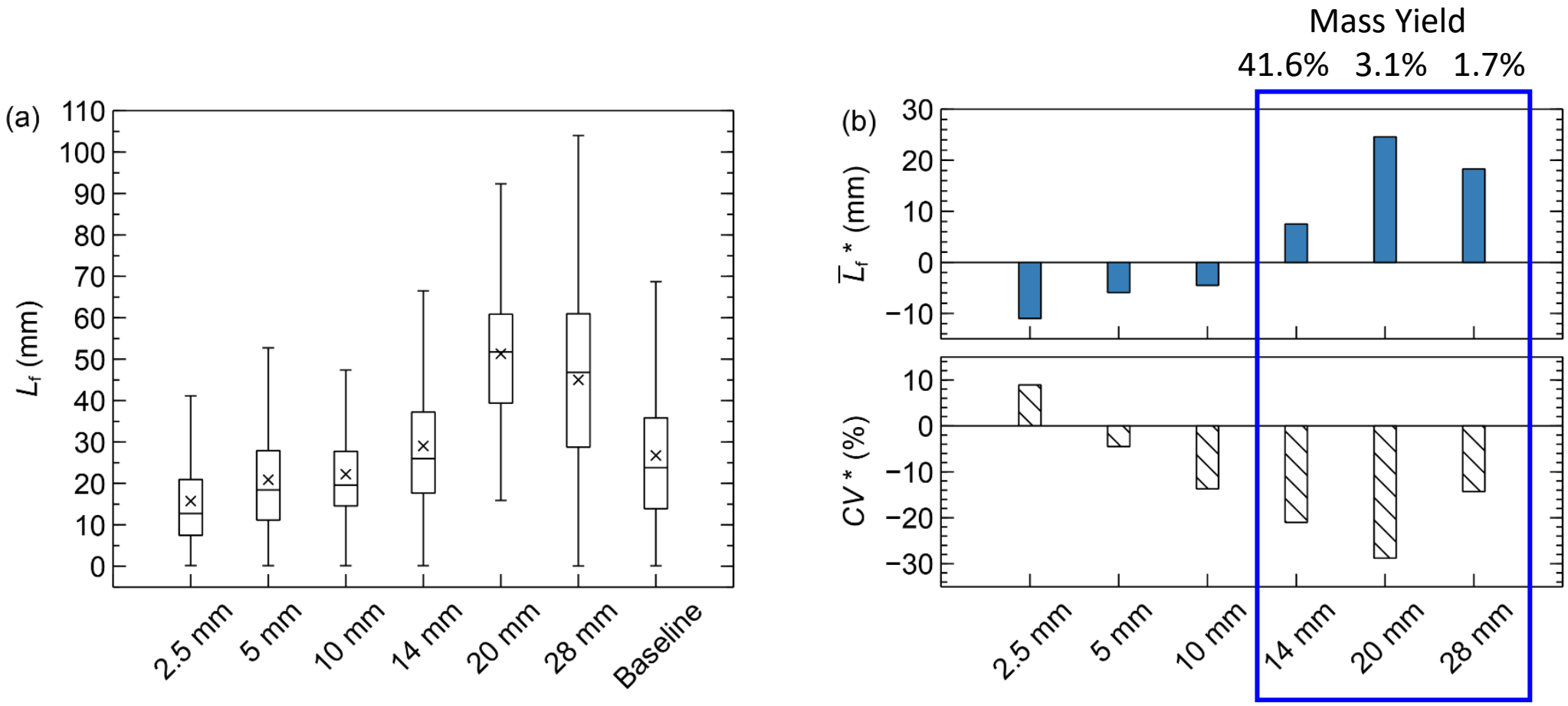
Effect of Sieving on Strand Geometry



TET Panel Manufacturing

<u>Moulding Parameters</u>

Dwell temperature: 400 °C

Consolidation pressure: 1 MPa

Dwell time: 30 min +/- 10 min

Slow cooling at 3-5 °C/min

<u>Tooling Info.</u>

Material: Invar 36

Cavity size: 30.5 cm x 30.5 cm

LMG 150-ton Press

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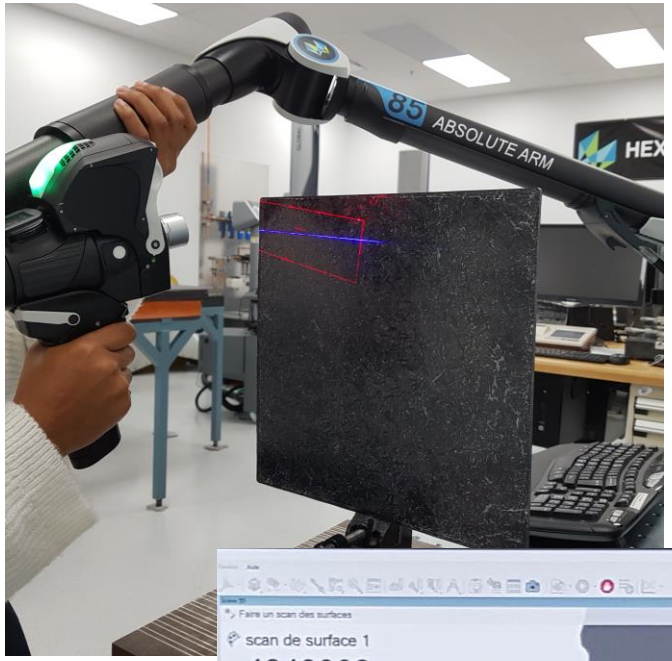
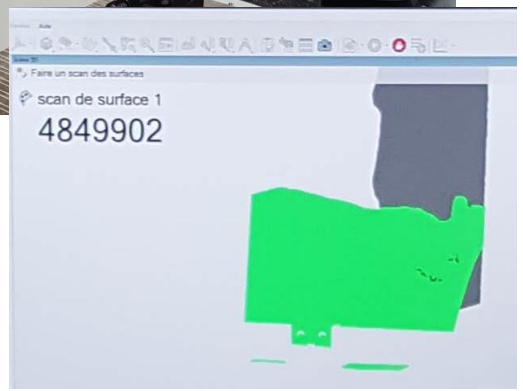
Panel Quality Evaluation

Visual
Canon DSLR + 105 mm Sigma

3D Scan
Hexagon 85 Absolute Arm





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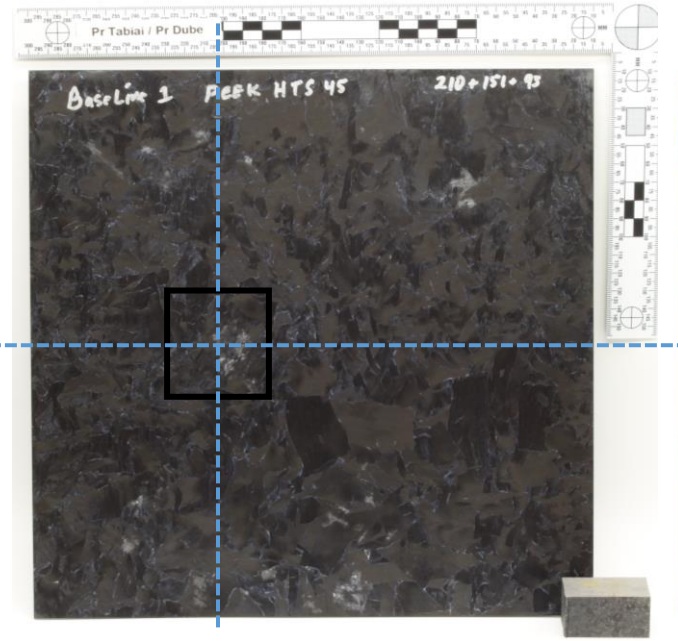
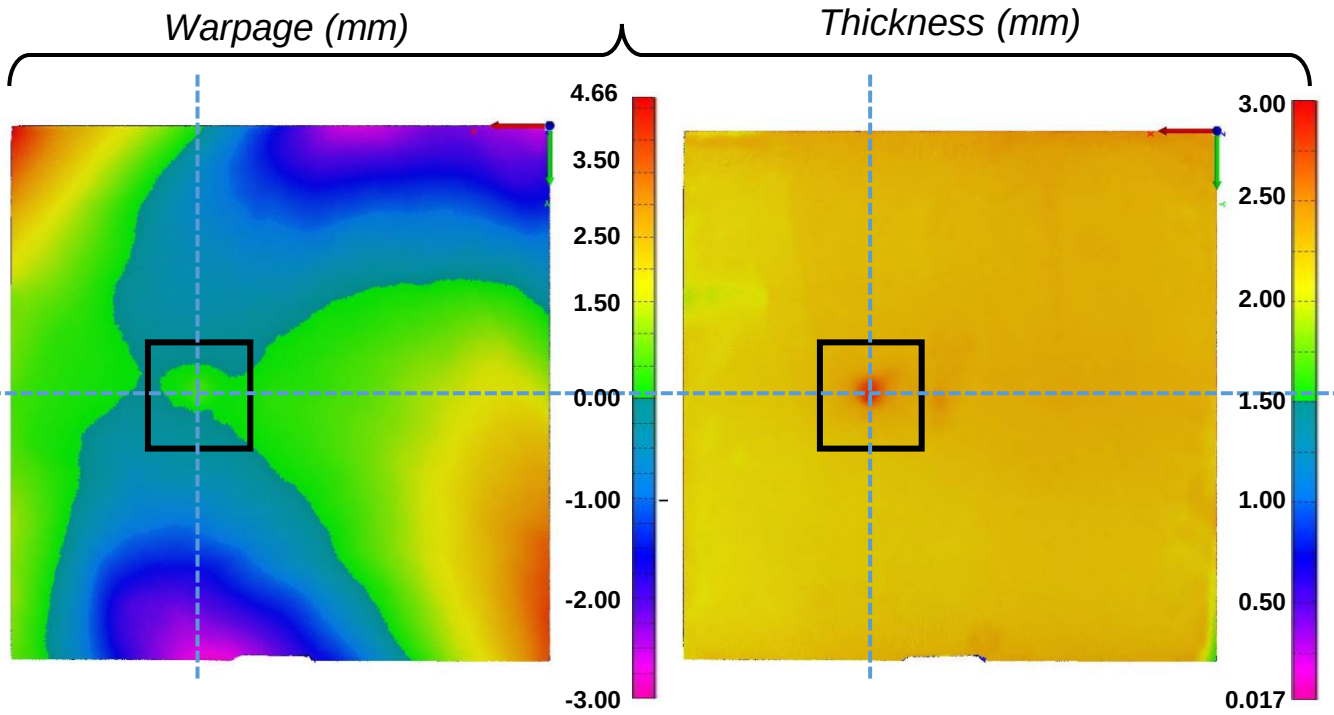
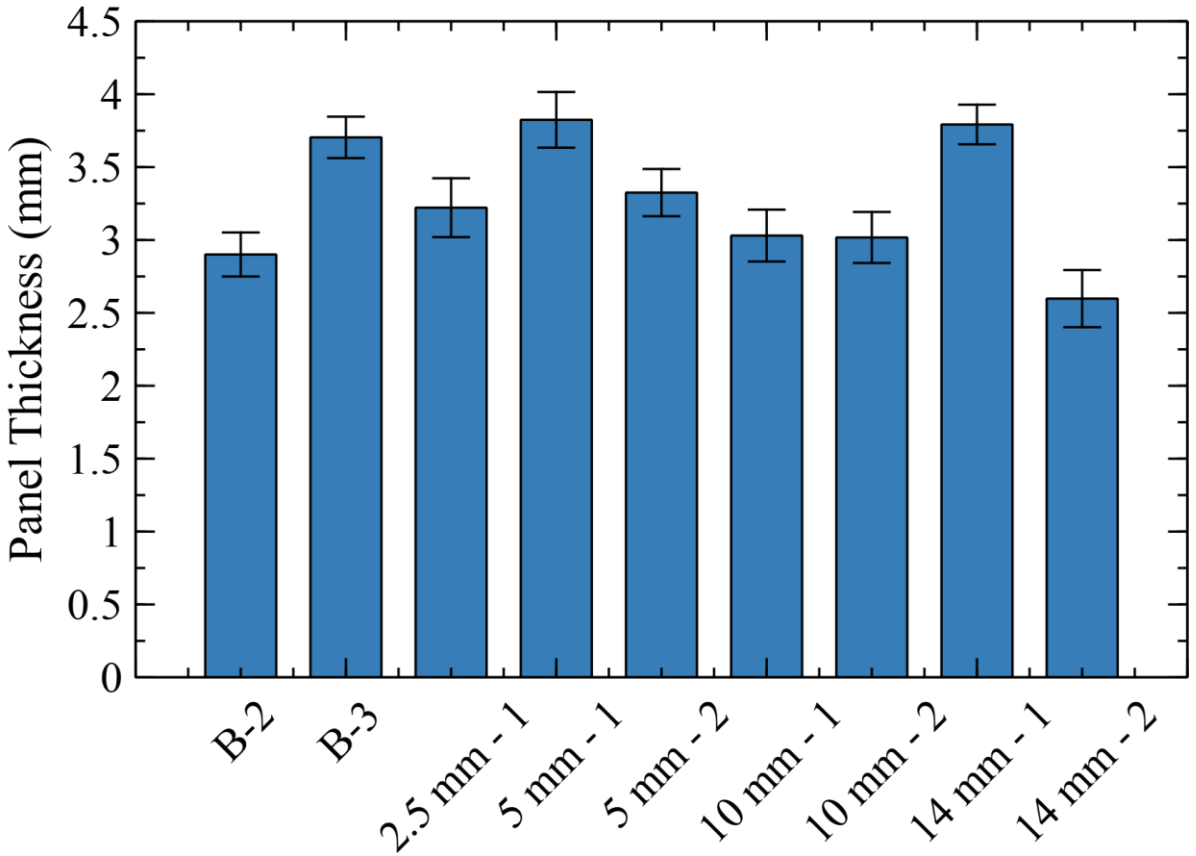




Panel Thickness Variation



- No correlation observed between sorting and panel thickness
- 2.60 – 3.82 mm avg. thickness range
- Avg. panel COV 5.33 %

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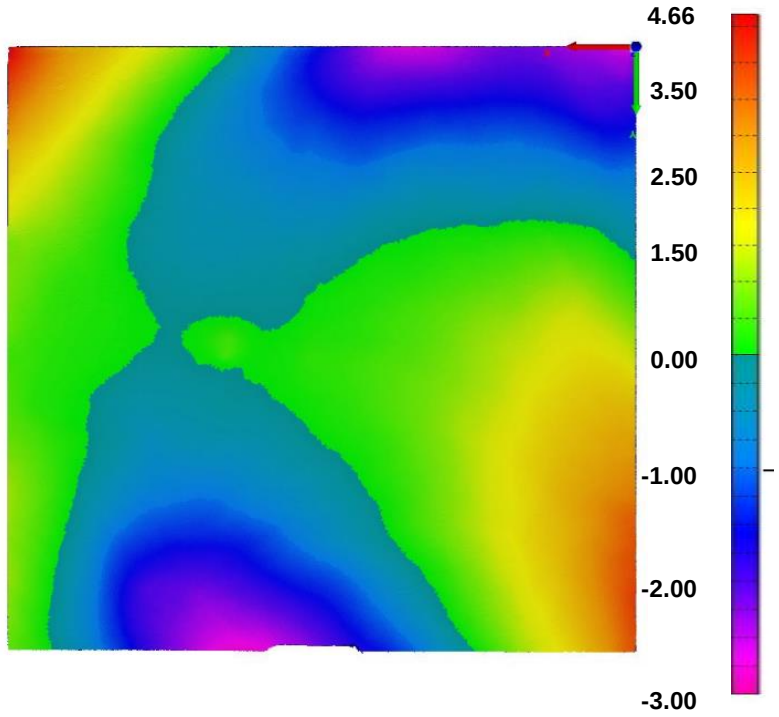
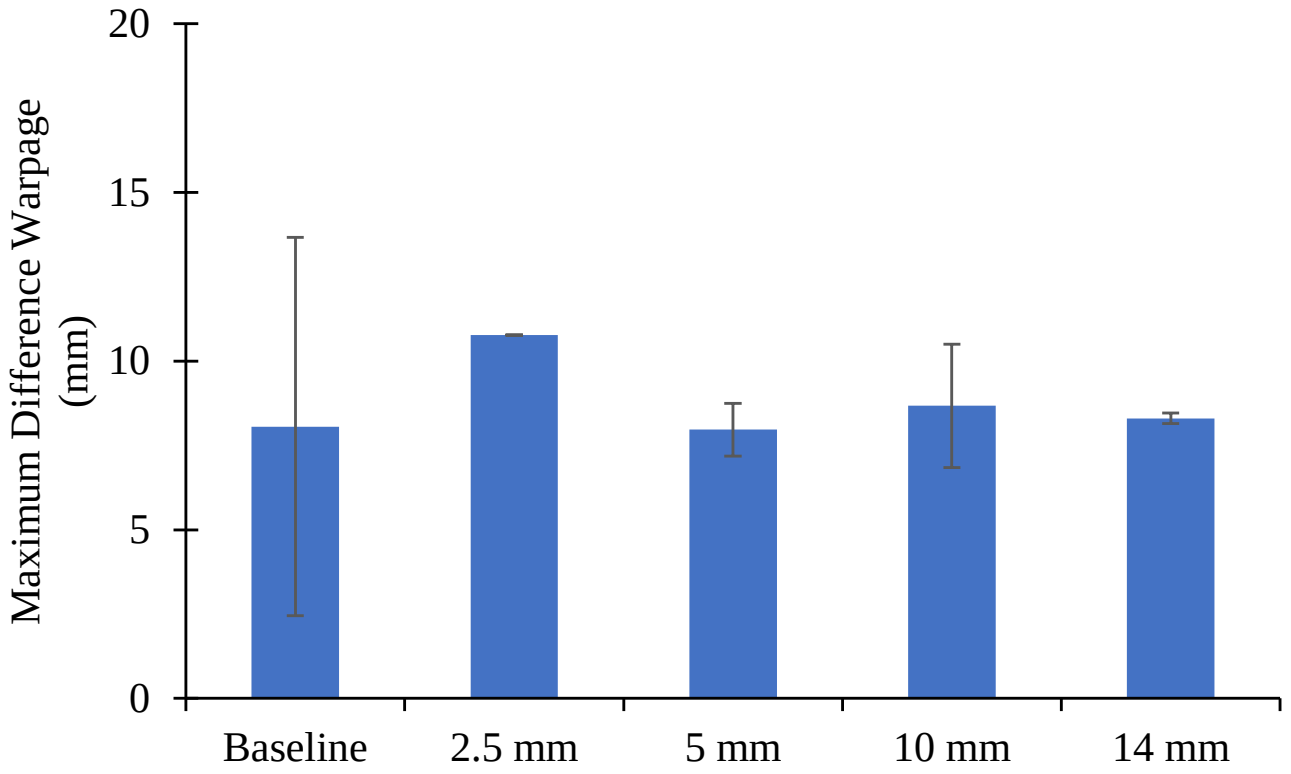
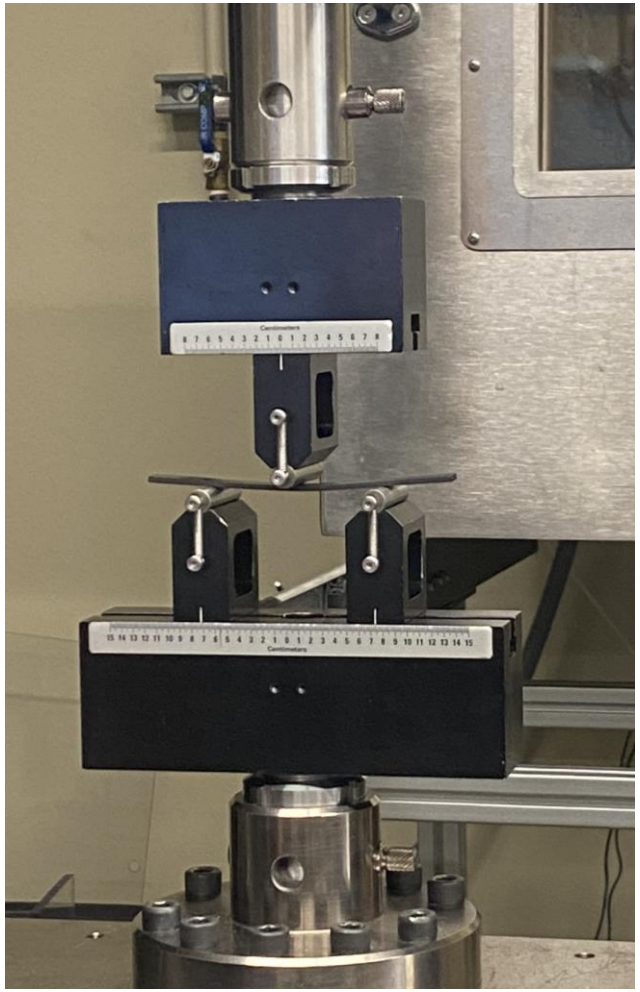
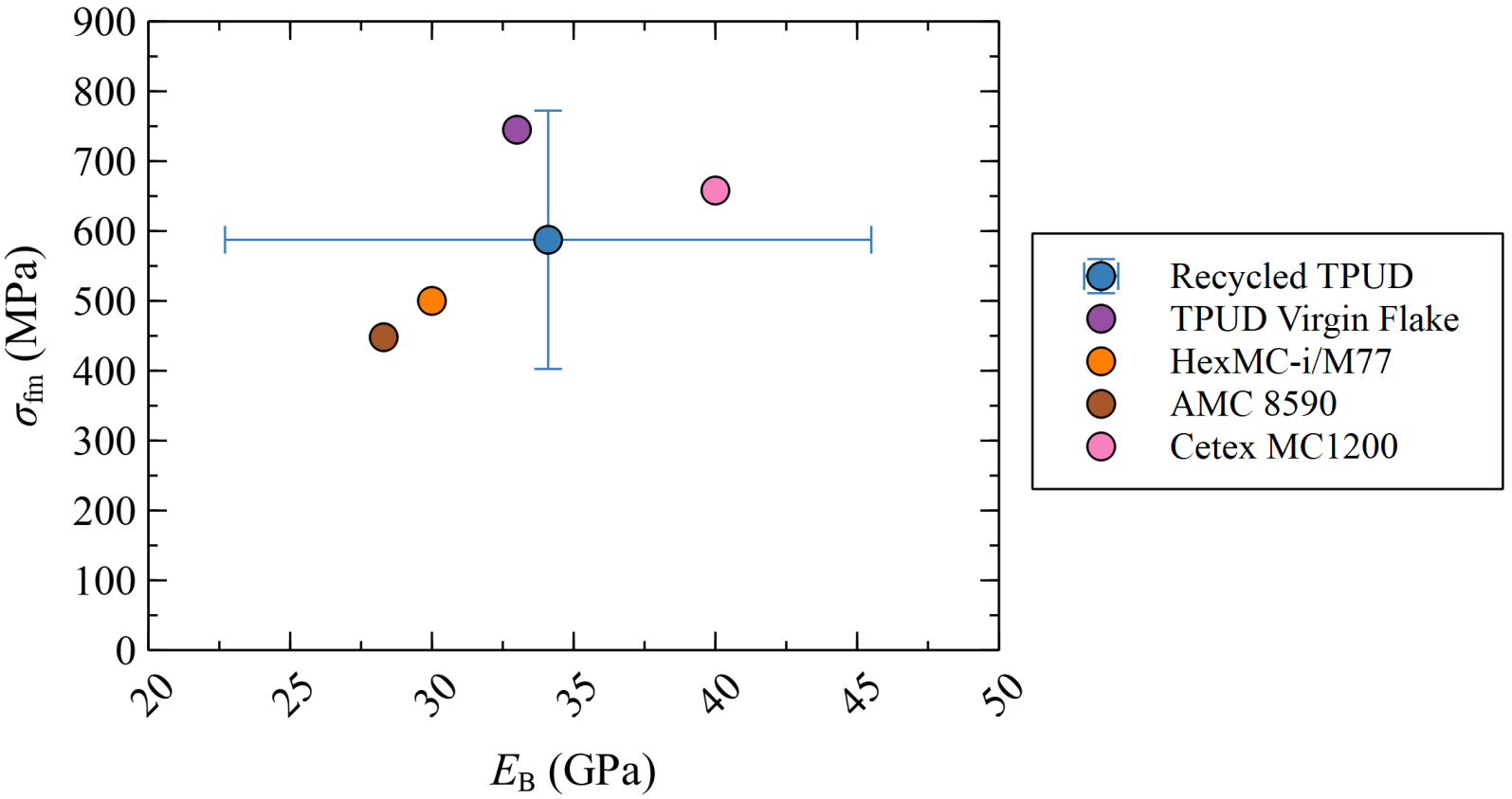




Flexural Properties





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