Composite Recycling for manufacturing feedstock applications

IACMI Webinar
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Chief Operating Officer
Carbon Fiber- Industrial Waste Recycling

Carbon Fiber

Carbon Fiber

Carbon Fiber

Carbon Fiber
Before vs. After recycling

- Tensile Strength
- Modulus
- Elongation
- Cost

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<table>
<thead>
<tr>
<th>SAMPLE</th>
<th>SAMPLE DESCRIPTION</th>
<th>TENSILE STRENGTH (MPa)</th>
<th>TENSILE MODULUS (GPa)</th>
<th>ELONGATION (%)</th>
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<tbody>
<tr>
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<td>MANUFACTURER’S SPECIFICATION</td>
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<td>295</td>
<td>1.5</td>
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<tr>
<td>A1</td>
<td>CONTROL</td>
<td>4850</td>
<td>298</td>
<td>1.60</td>
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<td>RECYCLING PROCESS – VARIANT B</td>
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<td>304</td>
<td>1.51</td>
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<td>D1</td>
<td>RECYCLING PROCESS – VARIANT D</td>
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<td>306</td>
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<td>E1</td>
<td>RECYCLING PROCESS – VARIANT E</td>
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<td>304</td>
<td>1.52</td>
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</table>
## Strength Comparison

<table>
<thead>
<tr>
<th></th>
<th>Tensile Strength (MPa)</th>
<th>Flex Strength (MPa)</th>
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<tbody>
<tr>
<td>Unfilled 100% Recycled PA6</td>
<td>67.2</td>
<td>91</td>
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<tr>
<td>Unfilled PA6</td>
<td>76</td>
<td>110</td>
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<tr>
<td>Recycled PA6 / 30wt% fiberglass</td>
<td>138.4</td>
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<tr>
<td>PA6 / 30wt% fiberglass</td>
<td>180</td>
<td>250</td>
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<tr>
<td>Recycled PA6 / 30wt% Vartega recycled carbon fiber</td>
<td>210</td>
<td>300</td>
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<tr>
<td>PA6 / 30wt% carbon fiber</td>
<td>221</td>
<td>331</td>
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</tbody>
</table>
Injection Moulding

- Carbon fiber/thermoplastic compounds
- Fill percentage dependent on desired part properties
- Hood/engine/exhaust part applications

Scrap

Recycled

Sized and compounded

Size Reduced
The evolution of manufacturing...

**INDUSTRY 1.0**
- Mechanization, steam power, weaving loom

**INDUSTRY 2.0**
- Mass production, assembly line, electrical energy

**INDUSTRY 3.0**
- Automation, computers and electronics

**INDUSTRY 4.0**
- Cyber Physical Systems, internet of things, networks

AMIDE Alliance

- Carbon Fiber Scrap Waste
- Recycled Chopped Carbon Fiber
- Unfilled Thermoplastic

= Carbon Fiber Filled Thermoplastic

→ Engineered Material

→ Finished Composite Part

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9.2 BILLION TONS OF PLASTIC HAVE BEEN PRODUCED SINCE 1950
Recycled Materials = Local Feedstock
3D Printing = Local Manufacturing
Open Minds = Local Innovation
Community Challenges = Local Value Proposition
Data Distribution = Global Value Proposition
MAKING CARBON FIBER MORE ACCESSIBLE TO MORE INDUSTRIES

Aerostace

Mobility

Wind Energy

Sporting Goods

3D Printing

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