Introduction to carbon fiber filaments

What you need to know to get started with carbon fiber reinforced filaments
Carbon fiber filaments are composites where carbon fibers have been added to a base material to enhance certain characteristics. It’s a new and exciting filament and thanks to its strength and dimensional stability a perfect choice for prototyping.

**What are carbon fiber filaments?**

Carbon fiber filaments are different from traditional carbon fiber materials. In conventional carbon fiber materials, long continuous carbon fiber strands are spun and later weaved into a sheet with the familiar look. In the filament however,
the fibers are chopped and milled before being mixed into a base material before it is extruded into filament form. The resulting filament retains most of the base material characteristics but with added strength from the microscopic carbon strands.

The ratio of carbon fiber to base material will differ from various suppliers

**When to use carbon fiber filaments?**

A carbon fiber enforced filament is ideal in situations where high structural strength and rigidity are necessary qualities in the print. Thanks to its excellent strength-to-weight ratio, a carbon fiber filament is the go-to choice for functional prints like mechanical parts, protective casings, and containers.

A carbon reinforced nylon filament also exhibits very good resistance against corrosion and chemical degradation, which makes it useful for parts in industrial settings.
Material properties

Filaments infused with carbon have a few unique characteristics. The filament will still retain the original properties of the base material. The micro-carbon strands make the prints stronger without taking away the advantages of using e.g. nylon or PETG in the first place.

**INCREASED STRENGTH**
The carbon fiber enforced filament provides a significant increase in strength and stiffness compared to the unfilled version.

**EXCELLENT DIMENSIONAL STABILITY**
The microscopic carbon fibers act as stabilizers that reduces shrinkage and warping. This helps the prints maintain the original dimensions giving you more accurate and consistent prints.

**LIGHTWEIGHT**
Since the density of carbon is lower than most base materials like nylon, prints made with carbon fiber filament are lighter than their base material equivalent.
Best practices for printing with carbon fiber filament

Printing with carbon fiber filaments doesn’t have to be more complicated than other materials but there are a few things you should know. Follow these best practices to make the most out of your carbon fiber prints.

USE A NOZZLE MADE FROM HARDENED STEEL

Since the extremely hard carbon fibers inside the filament don’t melt like the base material, printing with carbon fiber filament can be quite abrasive on the nozzle. The carbon fibers are much harder than a typical brass nozzle which leads to increased wear and tear.

Left: standard brass nozzle after printing 250g carbon fiber filament.
Right: Hardened steel nozzle after printing 2.5 kg of the same filament.
A nozzle made from hardened steel like NOZZLE-X is a better choice for printing carbon fiber filament.

At the moment, you can get a hardened steel nozzle at reduced price when buying our carbon fiber filament Adura™ X.

**REDUCED RETRACTION DISTANCE**

With the filament full of microscopic carbon fibers that don’t melt, there’s an increased risk of clogging. The fibers can build up and form clogs inside the extruder. To minimize the risk of clogging the extruder, reduce the retraction distance or disable retractions altogether.

**REDUCED PRINTING SPEED**

By reducing the printing speed, you’ll also run a lower chance of clogging. The lowered speed means the extruder will be under less stress.
**Recommended printer settings**

After rigorous research and careful testing, these are the settings we recommend when working with Adura™ X.

<table>
<thead>
<tr>
<th>Setting</th>
<th>Recommendation</th>
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</thead>
<tbody>
<tr>
<td><strong>Print temperature</strong></td>
<td>255–275 °C</td>
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<tr>
<td><strong>Hot bed</strong></td>
<td>&gt; 60°C</td>
</tr>
<tr>
<td><strong>Fan</strong></td>
<td>none</td>
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<tr>
<td><strong>Retraction</strong></td>
<td>minimal</td>
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<tr>
<td><strong>Print speed</strong></td>
<td>30-40mm/s</td>
</tr>
<tr>
<td><strong>Nozzle</strong></td>
<td>Wear resistant</td>
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</tbody>
</table>

Naturally, conditions may vary between different printers, which means you’ll have to try and experiment a little to find the sweet spot for your specific set-up.

For further inquiries, please contact support@addnorth.com