



Ingeo 3D Series for Additive Manufacturing

From high performance to a low carbon footprint, Ingeo™ PLA grades provide an unmatched portfolio of advantages in 3D printing. These Ingeo grades were developed to meet the demanding printing needs of hobbyists as well as evolving professional users and build on Ingeo's proven printability, delivering engineering-level performance.

3D PRINTING GRADES PORTFOLIO

INGEO 3D700 LARGE FORMAT PRINTS

Designed specifically for large format printing, Ingeo 3D700 delivers significant reduction in warping and improved interlayer adhesion, leading to minimized print failures. Optimized melt viscosity and microstructure allow for high throughput at a lower print temperature.

INGEO 3D450 BREAKAWAY SUPPORT

With the trend towards designing for additive manufacturing, with large formats and complex print geometries, functional support structures are essential. Combining the printability and low warping tendency of Ingeo with optimized adhesion, 3D450 provides good adhesion within the support structure, yet allows clean separation from the printed part.

INGEO 3D850 HEAT RESISTANCE

This grade exhibits faster crystallization rates and is able to develop improved heat resistance in 3D printed parts. This low color resin grade demonstrates the best performance in formulated systems designed to enhance toughness or heat resistance.

INGEO 3D870 HEAT AND IMPACT RESISTANCE

Engineered to deliver improved heat resistance and high impact strength to 3D printed parts, this formulated grade achieves thermal and mechanical properties similar to ABS while offering an alternative to styrenic-based materials.

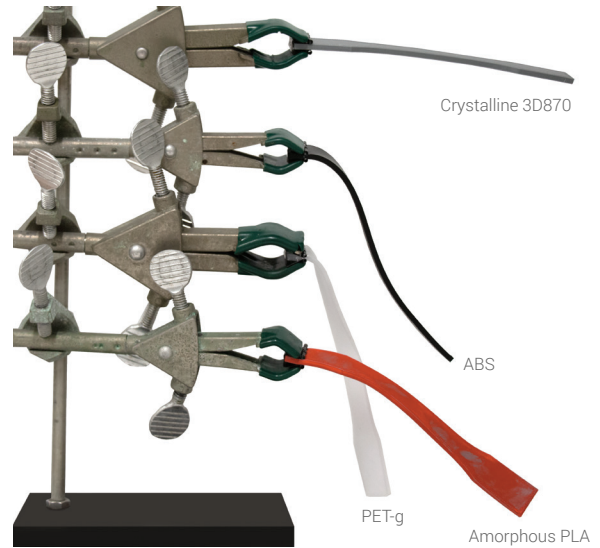
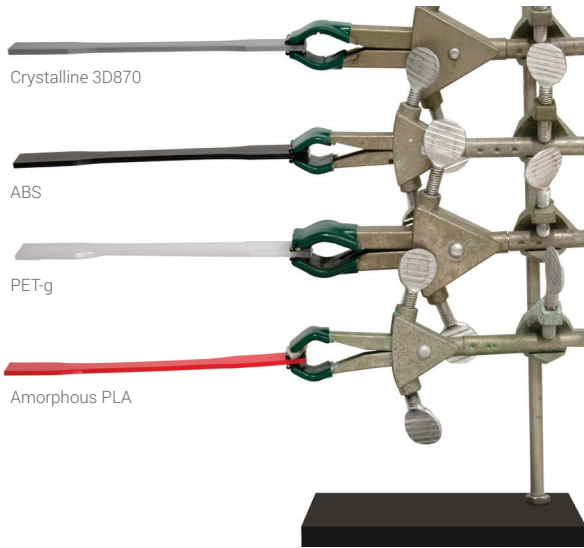
INGEO 4043D GENERAL PURPOSE

While not designed specifically for 3D printing, this general purpose Ingeo grade can be used to make quality basic filament.

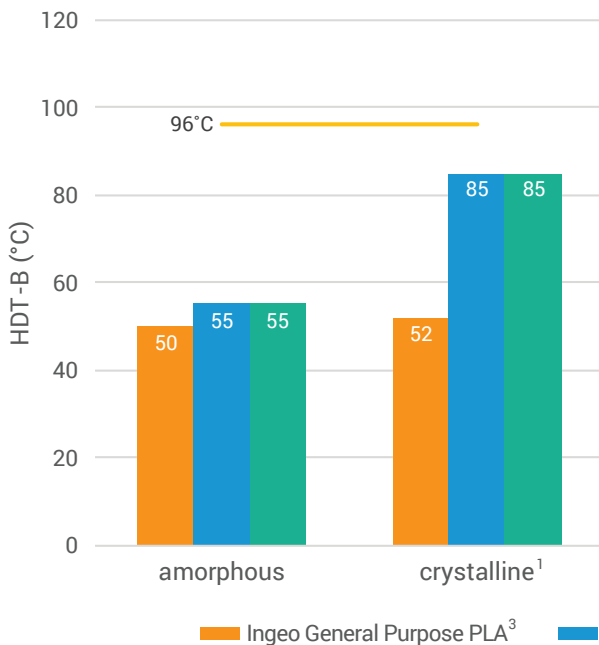


DESIGNED FOR HIGH HEAT & IMPACT RESISTANCE

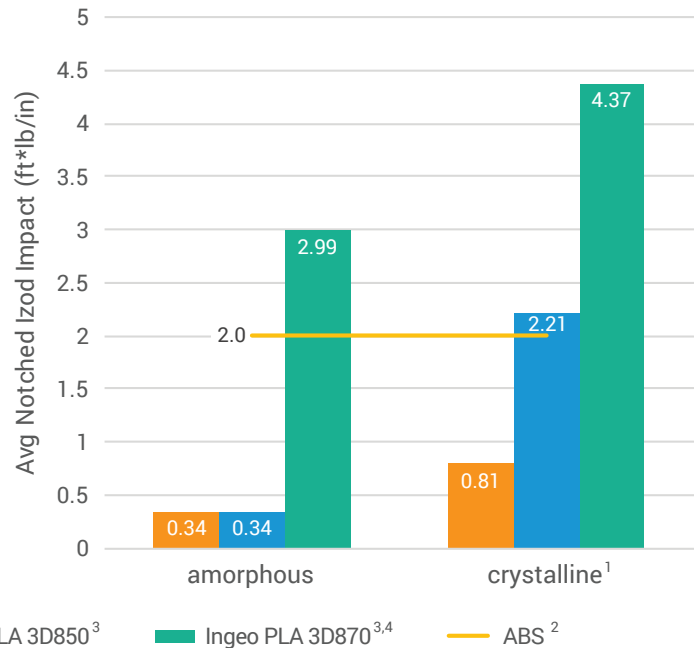
Once parts printed with Ingeo™ 3D870 have been annealed, the crystalline parts show dramatically improved heat resistance.



HEAT RESISTANCE



IMPACT STRENGTH



1. Annealed for 10-20 min @ 110-120°C

2. Values from literature.

3. All test bars were 3D printed at 100% infill. For more on orientations of printed parts, see the Ingeo 3D870 technical data sheet on www.natureworksllc.com.

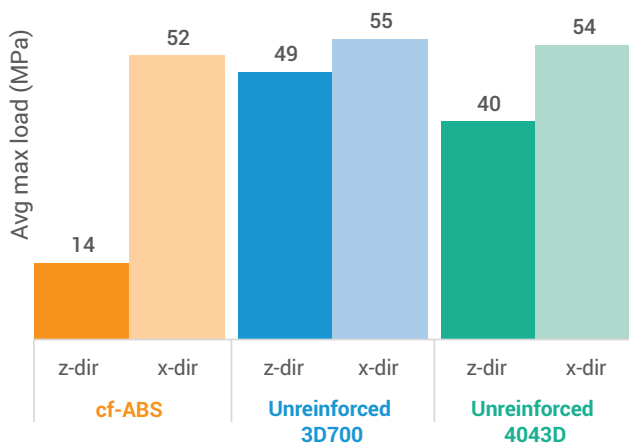
4. 3D870 was tested by Essentium Materials.

INGEO BRINGS EXCELLENT PERFORMANCE IN 3D PRINTING

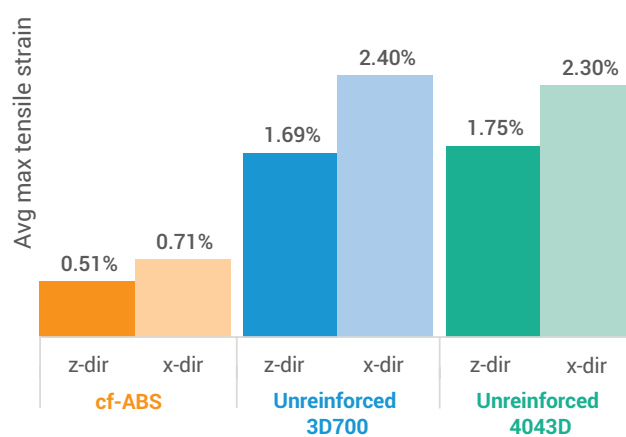
PERFORMANCE REQUIREMENT	MARKET EXPECTATION	INGEO PERFORMANCE	ABS PERFORMANCE
Temperature in printing	Lower is better for safety and control	190-230°C possible, sharp melting behavior	230-250°C
Vapor or odor in printing, EH&S	Low or no emissions, low order and low ultrafine particle count	Very low emissions & studies show lower particulate count	Strong negative odor and higher particulate count
Heated build chamber	Ideally not required and many desktop and large-format printers lack this capability	Does not require heated build chamber, but opportunity to leverage	Required to avoid warping while mfg. larger parts
Fusing performance	Fuses easily, sticks well to self and build platform	Good fusing and build platform adhesion	Difficult to stick to certain build platforms
Thermal shrinkage	Low shrinkage and warping	Excellent, low shrink	Warp on larger builds

INGEO 3D700 DELIVERS ISOTROPIC MECHANICAL PROPERTIES AND REDUCED WARPAGE

3.5x greater z-direction strength than carbon fiber reinforced (CF)-ABS



Improved elongation vs. carbon fiber reinforced (CF)-ABS



3D700 offers performance improvements over carbon fiber reinforced ABS, including improved x- and z-layer adhesion and tensile strain.

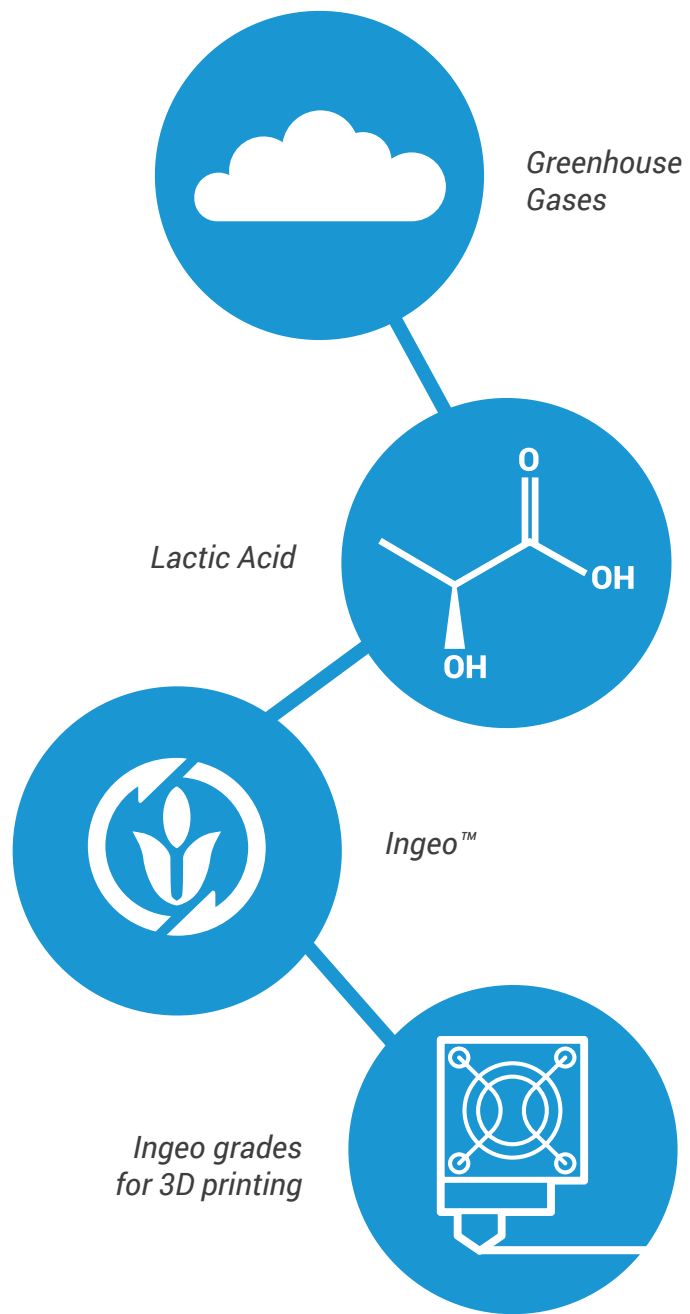
Reduced warping and shrinkage means higher accuracy parts, precision prints, and improved gap filling. The optimized microstructure and melt viscosity allows for faster print speeds, higher throughput, and the opportunity to print at temperatures under 200°C.

3D700 processes similarly to other Ingeo grades and maintains the high-quality print performance that Ingeo is known for on desktop and medium sized printers.

HOW INGEO IS MADE

Locally abundant and rapidly renewable plant resources capture and sequester atmospheric carbon over their growing season, producing simple sugars via photosynthesis.

Through a process of fermentation and separation, these harvested plant sugars are converted into lactic acid. A safe material naturally present in our bodies and in many of our foods, this lactic acid building block is transformed into Ingeo, a performance thermoplastic with physical characteristics and performance tailored for filament production and printing.



Driven by curiosity and obsessed with science, NatureWorks meets the challenges of our partners and a changing world creating more responsible high performance materials for a more sustainable future.

NatureWorks' headquarters and advanced biopolymers research and development facility is located in Plymouth, MN. The full portfolio of Ingeo™ biopolymers are manufactured at a 150,000 MT/yr production facility in Blair, NE with a new 75,000 MT/yr fully integrated manufacturing complex under construction in Thailand anticipated to open in 2025.

NatureWorks is jointly owned by PTT Global Chemical and Cargill.