



DEGRAD **INX**[®] X100

High Resolution Biodegradable Resin



DEGRAD INX[®] X100 is a polyester-based synthetic resin for multiphoton lithography (MPL) based 3D-printing applications. It is the first ever biodegradable ink that combines the benefits of biocompatibility, flexibility and easy processability resulting in high feature resolutions (< 500 nm).

DEGRAD INX[®] X100 is suitable for the fabrication of 3D complex architectures for tissue engineering applications.

SUPERIOR SHAPE FIDELITY AT HIGH RESOLUTION

The DEGRAD INX[®] X100 ready-to-use formulations can be processed via a MPL based printer after a short pre-heating process. The resin can be processed at high scanning speeds (up to at least 600 mm/s) which is favorable for shorter fabrication times.

Figure 1 shows DEGRAD INX[®] X100 structures that were printed via MPL technology. Complex and open geometries can easily be printed via DEGRAD INX[®] X100 thanks to its mechanical robustness. The possibility to print structures with feature sizes below 500 nm is favorable for tissue engineering applications as well as systematic investigation of cell-material interactions in 3D.

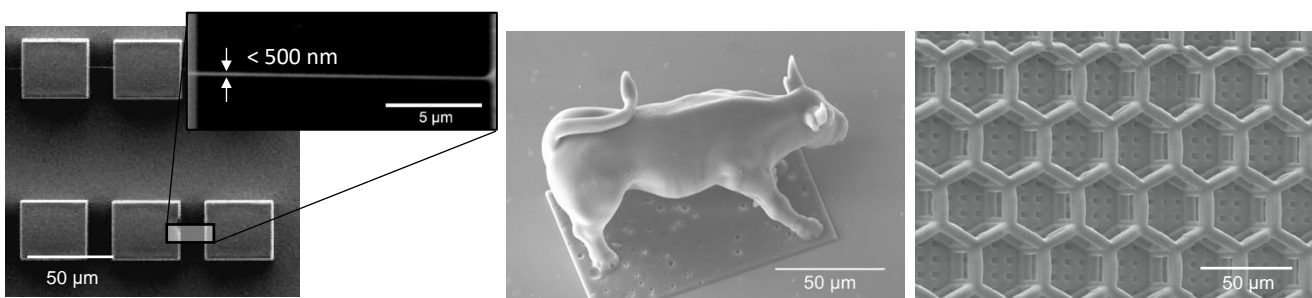


Figure 1: Scanning electron microscope images of the structures printed using DEGRAD INX[®] X100 via multi-photon lithography



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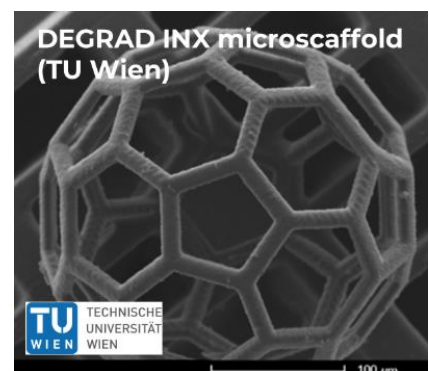
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BENEFITS

- ✓ Biocompatibility Exceptional biocompatibility (ISO 10993-5) with no toxic effect on living cells
- ✓ Biodegradability Degradable in a long term (3-5 years) when in contact with water or biological fluids
- ✓ Processability Easy processing into open and complex architectures with minimal deformation
- ✓ High resolution Highest resolution ever reported for a biodegradable material (< 500 nm)
- ✓ Flexibility Can generate strong yet flexible structures that are favorable for easy handling and processing
- ✓ Easy to handle Provided as ready-to-print formulation in amber vials
- ✓ Reproducibility Production under strict quality control to provide a material that delivers every time

APPLICATIONS

Scaffolded spheroids can be generated by integrating single spheroids (e.g. human adipose-derived mesenchymal stem cells) into DEGRAD INX[®] X100 microscaffolds, as a “third tissue engineering strategy”. In this way, tissues with high degree of maturity (e.g. cartilage) can be produced by the bioassembly of chondrogenically differentiated scaffolded spheroids. The third tissue engineering strategy showed advantages compared to traditional spheroid cultures, as the fusiogenic potential of the scaffolded spheroids have not been altered, while the size of tissues formed by the scaffolded spheroids fusing together is more stable over time compared to traditional, non-scaffolded spheroids.



Read more in following publications:

- Kopinski-Grünwald, O. et al. (2024) *Acta Biomaterialia*, 174, 163-176
- Guillaume, O. et al. (2023) *Acta Biomaterialia*, 165, 72-85





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PROPERTIES & PROCESSING

DEGRAD INX[®] X100 is a viscous liquid at room temperature. It provides easy and fast processing given its wide processing window. Stable structures can be printed with DEGRAD INX[®] X100 using laser powers in the range 30-100 mW and scanning speeds up to at least 600 mm/s.

Physical Properties	DEGRAD INX [®] X100
Appearance	Yellow - orange liquid at 20°C
Viscosity (Pa.s)	0.5 - 3
Refractive index	1.46 - 1.48
Young's modulus (MPa)	50 - 60
Ultimate strength (MPa)	5 - 10
Elongation at break (%)	20 - 30

Upon printing & developing processes, DEGRAD INX[®] X100 results in strong yet flexible structures (Figure 2) with a high deformation energy (900-1000 kJ/m³). Compared to the highly rigid and brittle structures of current commercial organic-inorganic hybrids, this feature of DEGRAD INX[®] X100 makes it an excellent candidate for various applications requiring flexibility and easy handling. In addition to these features, DEGRAD INX[®] X100 has a degradation profile similar to the commercial linear poly(ϵ -caprolactone) (PCL), as observed in degradation tests that were conducted in accelerated conditions (Figure 3).

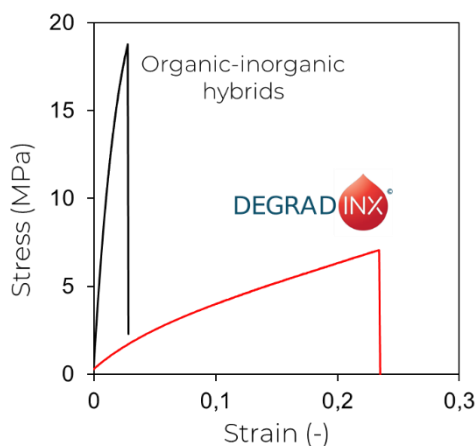


Figure 2: Stress-strain curve of DEGRAD INX[®] X100 after crosslinking

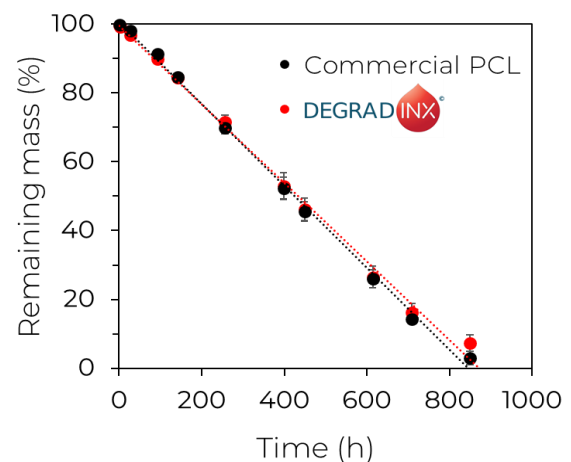















Figure 3: Degradation profile of DEGRAD INX[®] X100 and a commercial PCL tested in accelerated conditions



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BENEFITS OF DEGRAD INX[®] X100

	Organic-Inorganic Hybrids	DEGRAD  X100
Strength		
Flexibility		
Biodegradability		
Biocompatibility		
High resolution		
High reactivity		

3D PRINTER COMPATIBILITY

Our resins have been used repeatedly and successfully with the following printers:

- ✓ Upano NanoOne
- ✓ Upano NanoOneBio
- ✓ Nanoscribe Photonic Professional GT2

If you would like to discuss your printer's compatibility with our resins, please contact us at info@bioinx.com