



# xPRO1100-Black

## Basic Properties

Measurement	Unit	Test Method	2x30min in XiP Cure, 1x60min in xCure	2x10min 100% in xCure Desktop	2x30min in XiP Cure, 1x60min in xCure + 2hrs @100°C	2x10min 100% in xCure Desktop + 2hrs @100°C
<b>Tensile Properties</b>						
Young's Modulus	MPa	ASTM D638	2870	2990	2940	3010
Ultimate Tensile Strength	MPa	ASTM D638	67	73	72	71
Elongation at Break	%	ASTM D638	4.6	3.9	4.7	4
<b>Thermal Properties</b>						
HDT at 1.82 Mpa	°C	ASTM D648	61	72	69	93
HDT at 0.45 Mpa	°C	ASTM D648	77	95	97	112
<b>General Properties</b>						
Viscosity at 25°C (77°F)	cP	ASTM D7867	280			
Viscosity at 30°C (86°F)	cP	ASTM D7867	190			
Liquid Density	g/cm <sup>3</sup>	ASTM D4052-18a	1.11			
Solid Density	g/cm <sup>3</sup>	ASTM D792	1.2			
<b>Biocompatibility</b>						
Cytotoxicity		ISO 10993-5		Pass		

## BASF Extended Properties

Measurement	Unit	Test Method	Post Processed
<b>Flexural Properties</b>			
Flexural Modulus	MPa	ASTM D790	2790
Flexural Stress	MPa	ASTM D790	125
<b>Impact Properties</b>			
IZOD Impact (Notched)	J/m	ASTM D256	21
Charppy (Notched)	kJ/m <sup>2</sup>	ISO179-1	1.11
<b>Advanced Thermal Properties</b>			
Glass Transition Temperature (DMA, tan(d))	°C	ASTM D4065	141
Degradation temperature (TGA, 5% mass loss, air)	°C	ISO11358	339
<b>FST Properties</b>			
Flammability		UL94	HB (1.5mm)
Hot-Wire Ignition (HWI)		UL746A	PLC4 (0.75mm)
			PLC4 (1.0mm)
			PLC2 (2.0mm)
			PLC1 (3.0mm)
Glow-wire Test		IEC 60695-2-12-13 (2mm)	GWIT: 675°C GWF1: 650°C
<b>Other Properties</b>			

Water Absorption (24hr)	%	ASTM D570	0.14
Water Absorption (>2500hrs)	%	ASTM D570	2
Shore Hardness	D	ASTM D2240	84

## Printing Process

The material should be processed at room temperature. Before usage, the material should be shaken well. Pour it slowly into the vat and wait a couple of minutes, until a smooth, bubble-free surface is obtained before starting the print job.

The 3D printer examples and settings stated above are only for general guidance. The fully optimized settings should always be determined by the users themselves, according to their specific needs. Please always refer to the user manual of the employed 3D printer for instructions on printer settings and handling.

Remove the parts carefully from the build platform with a suitable tool, for more information, refer to the user manual of the used 3D printer.

## Washing

xPRO1100-Black requires post processing to achieve specified properties. Prior to post curing, the part should be washed. Nexa3D recommends using xClean followed by IPA as standard cleaning procedure. Parts should not be submerged in xClean for longer than 2 minutes or in IPA for longer than 5 minutes to avoid any impact on performance.

## Examples of Additional Thermal Treatment After UV Post-Curing

	Thermal Oven	
Ramp up phase	Heat up with oven	Room temperature to 100°C
Holding phase	2 hours	100°C
Ramp down phase	Cool down with oven	100°C to room temperature

## UV Ageing

Durability is a key feature for the components utilized within many industries, as they expect the materials used to withstand years of exposure to the elements. Through the effects of UV radiation, photopolymers can degrade over time. The aging can be caused by the influence of UV light, heat and water. The degree of aging depends on duration and intensity.

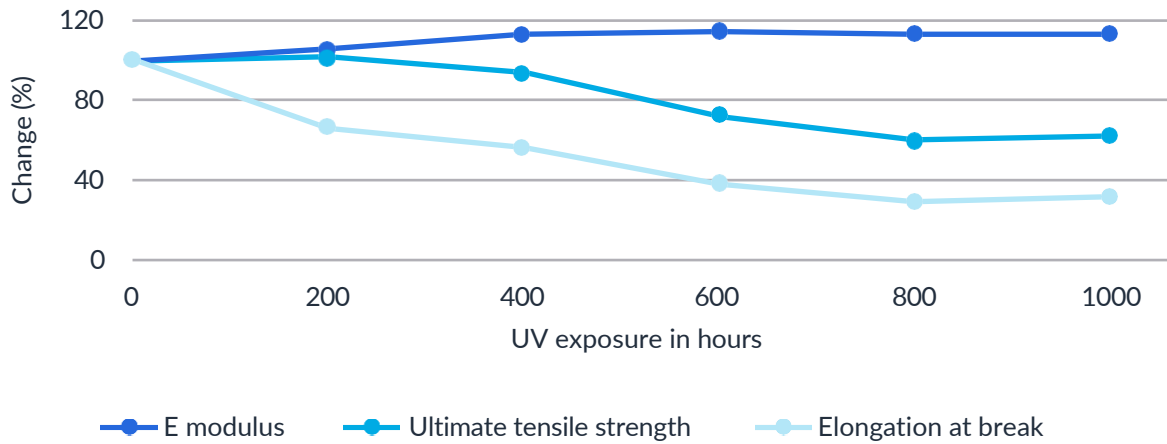
## Test Method and Specimens

The aging tests were performed with ASTM D638 type IV tensile bars and color cones as per ISO 4892-2:2013 method A, cycle 1. Exposed samples were always removed at the end of a dry cycle, and conditioned for 24 hours at 22°C before mechanical testing.

Cycle No.	Exposure period	Irradiance		Black standard temperature in °C	Chamber temperature in °C	Relative humidity in %
		Broadband (300 nm to 400 nm) in W/m <sup>2</sup>	Narrowband (340 nm) in W/(m <sup>2</sup> nm)			
1	102 min dry	60 ± 2	0.51 ± 0.02	60 ± 3	38 ± 3	50 ± 10
	18 min water spray	60 ± 2	0.51 ± 0.02	-	-	-

Testing conditions for ISO 4892-2 method A, cycle 1

## Mechanical Testing



*Change in mechanical properties after accelerated weathering*

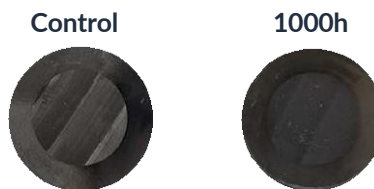
The final values after 1000 hours of long-term UV exposure can be found below.

Property	Before long-term UV exposure	After 1000 hours of UV exposure
E modulus	2700 MPa	3000 MPa
Ultimate tensile strength	67 MPa	41 MPa
Elongation at break	4.6%	1.5%

*Mechanical properties before and after accelerated 1000 hours of UV exposure as per ISO 4892:2 method A*

## Coloration

After being exposed up to 1000 hours, xPRO1100-Black did not show significant change in color.



*Effect of UV exposure on color of the specimens*

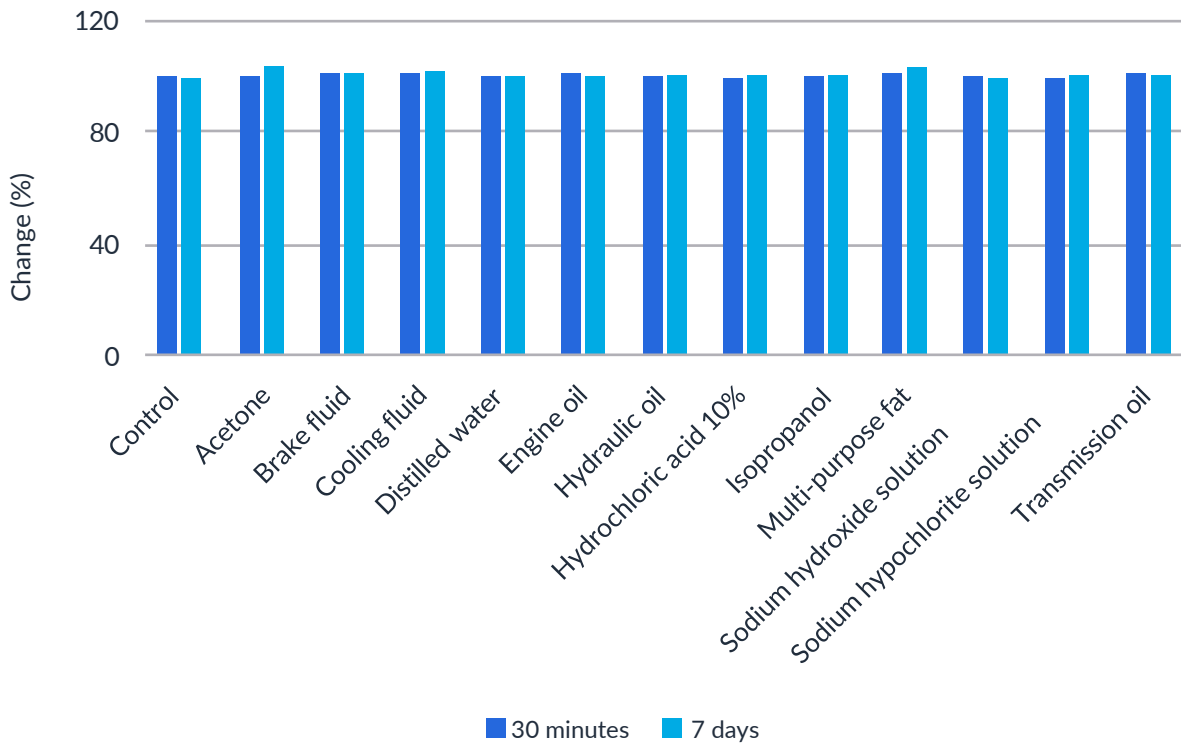
## Industrial Chemical Resistance

The resistance of resin materials against chemicals, solvents and other contact substances is an important criterion of selection for many industrial applications. General chemical resistance depends on the period of exposure, the temperature, the quantity, the concentration and the type of the chemical substance. When exposed to industrial chemicals, the chemical bonds of photopolymers can break or degrade, causing a change in the mechanical properties.

### Test Method and Specimens

ASTM D638 type IV tensile bars were soaked in each fluid at room temperature, one set for 30 minutes and one set for 7 days. Upon completion of the soaking time, the parts were removed from the test fluid and were dried to measure the weight and the mechanical properties.

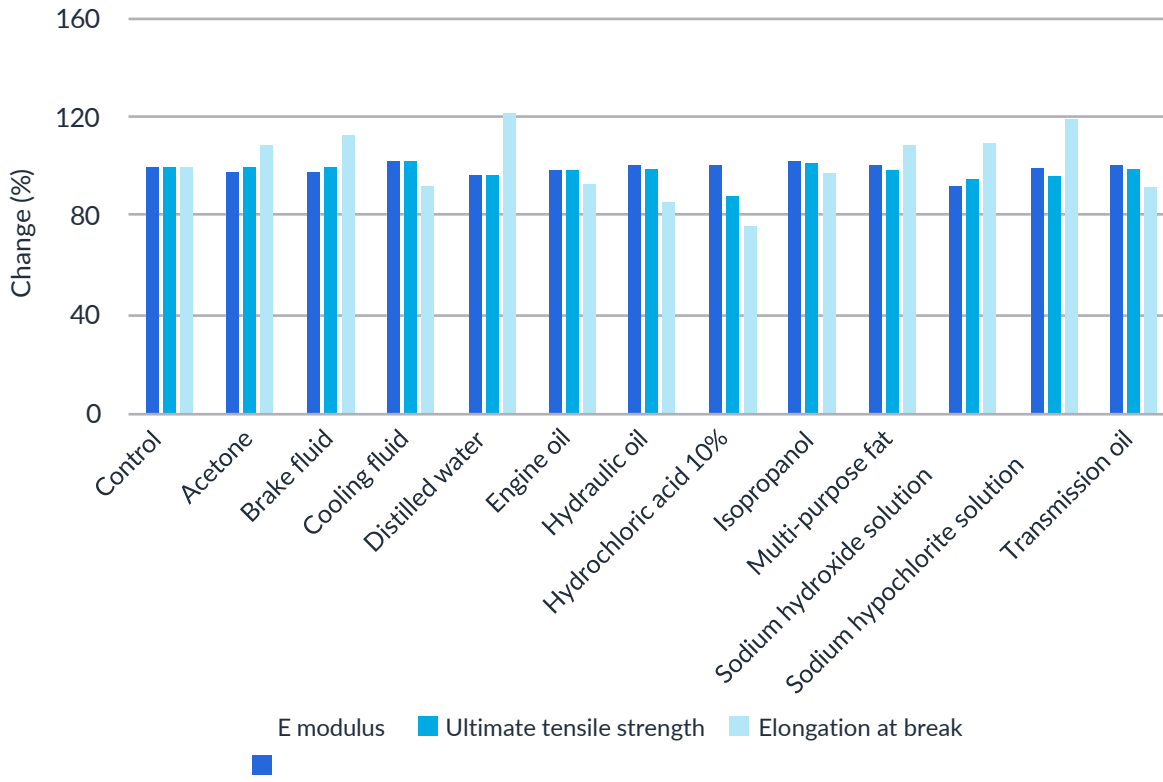
### Weight Measurement



Change in weight after immersion time

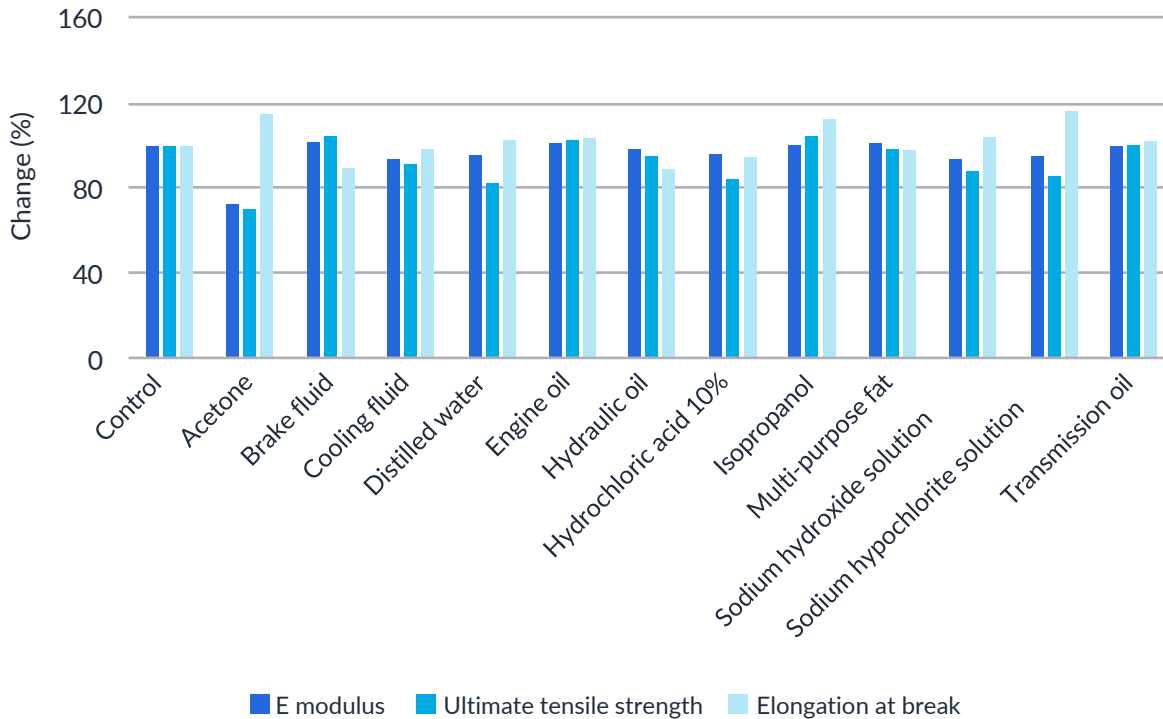
## Mechanical Testing

30 minutes



7 days

Change in mechanical properties after 7 days immersion



Change in mechanical properties after 7 days immersion

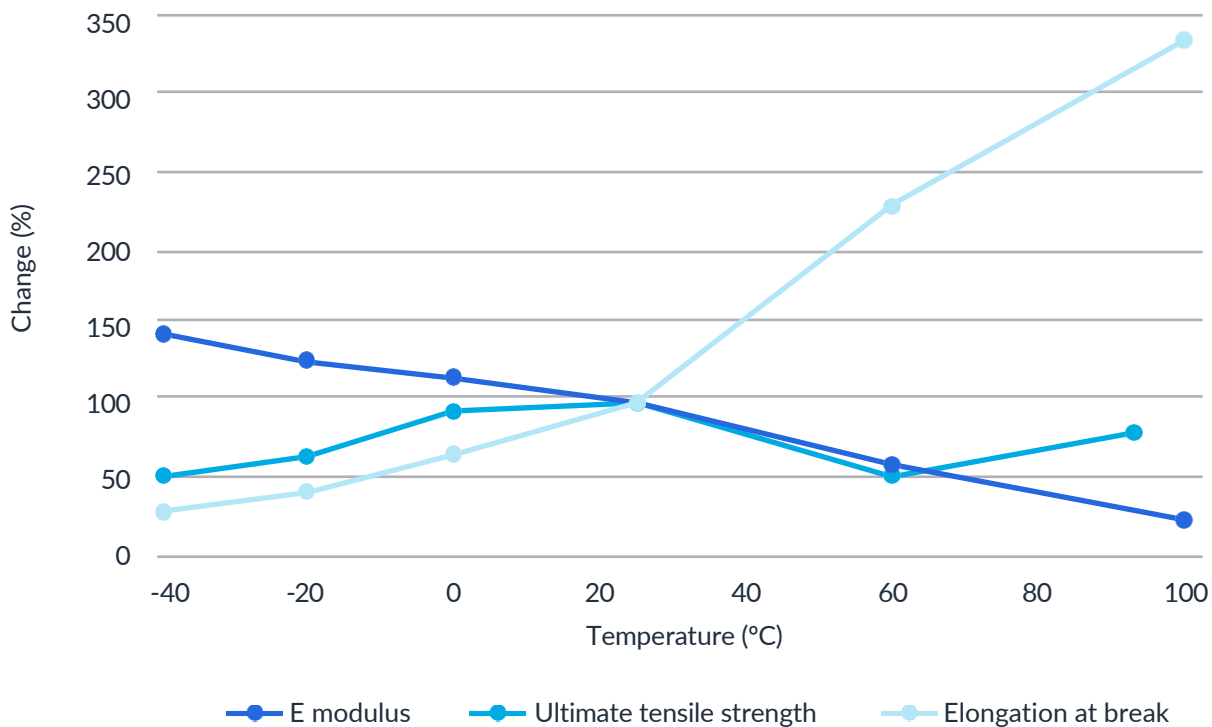
## Temperature Dependence of Mechanical Properties

Temperature can have a substantial effect on material performance. Measuring these data can help to determine whether the material is suitable for applications that require a certain performance at very low or high temperatures.

### Test Method and Specimens

Tensile bars were tested at various temperatures, ranging from -40°C to 100°C. Samples were conditioned for 60 minutes at their respective test temperatures before measurements were started. The data at 25°C were taken as the reference point.

### Mechanical Testing



Change in mechanical properties at -40°C to 100°C

## Pressure & Temperature Resistance

The pressure and temperature performance of a material is key to enabling a broad range of applications and industries. Both can have a drastic effect on mechanical properties, therefore testing under these certain conditions can give an idea of the resistance of a photopolymer.

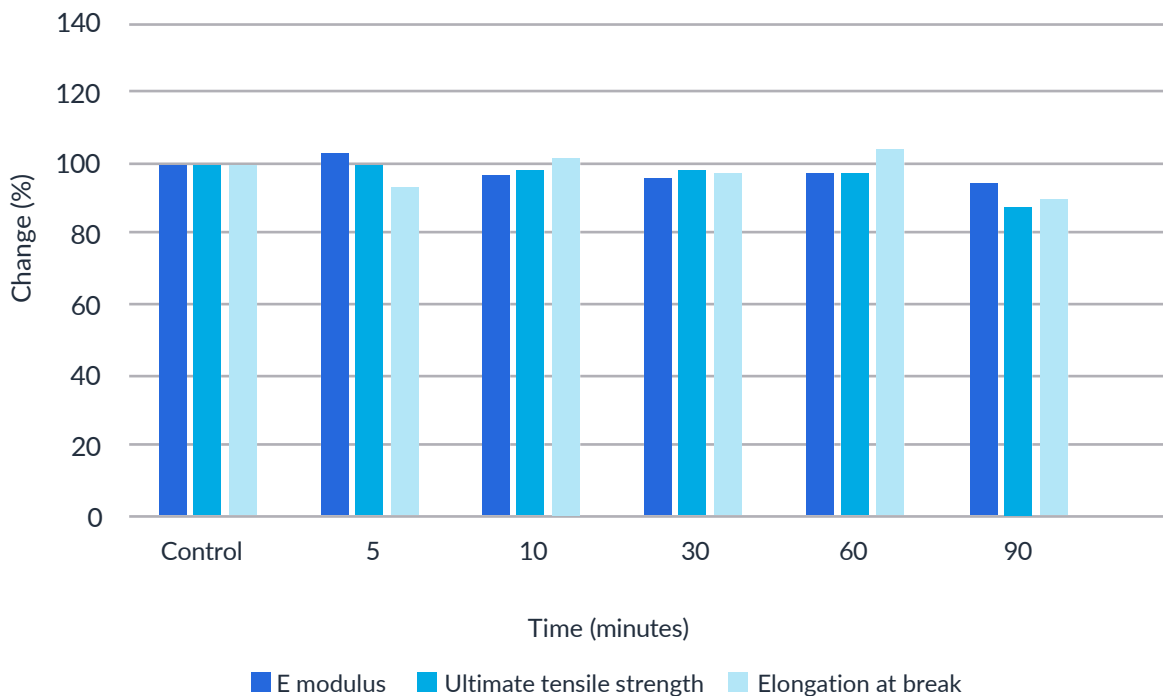
### Test Method and Specimens

ASTM D638 type IV tensile bars were immersed in water with exposed to pressure from all sides and tested according to the conditions listed below, the effect on mechanical properties was investigated.

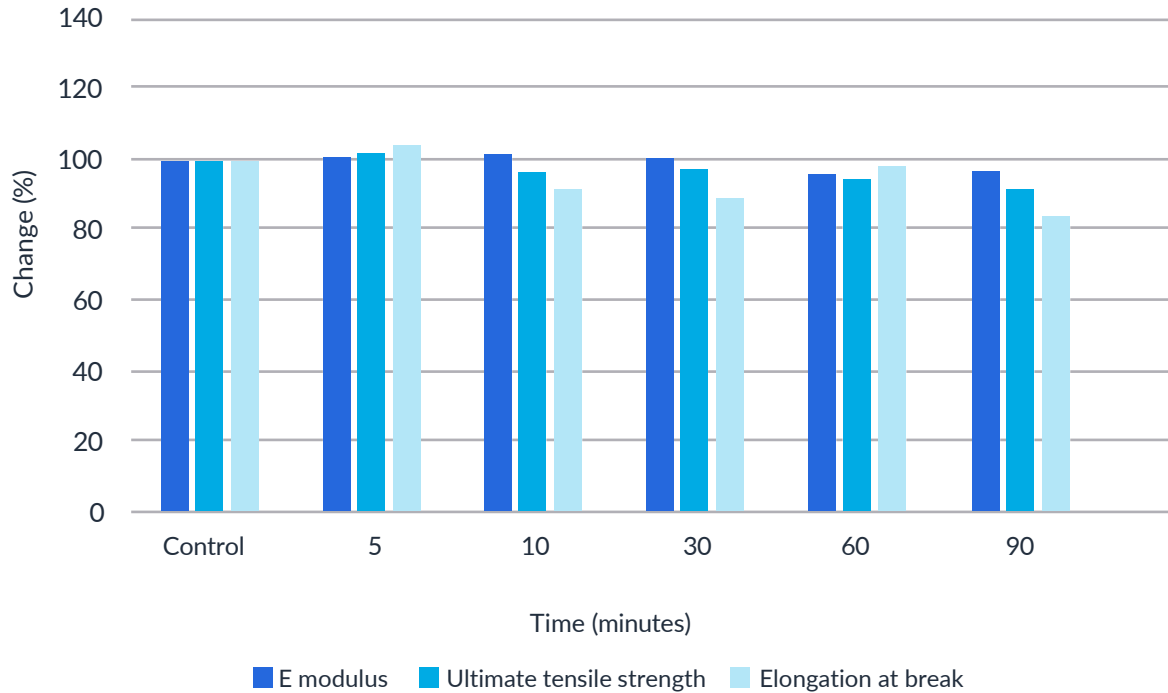
Pressure from all sides	Temperature	Time
5 bar	75°C	5 minutes, 10 minutes, 30 minutes, 60 minutes and 90 minutes
5 bar	90°C	5 minutes, 10 minutes, 30 minutes, 60 minutes and 90 minutes

*Testing conditions pressure, temperature and time*

### Mechanical Testing



*Change in mechanical properties, 75°C*



Change in mechanical properties, 90°C

## Sterilization

Sterilization is an essential requirement in many applications, especially when used in the medical field. Testing not only ensures the material quality but also determines how effectively the chosen sterilization process is eliminating potential microorganisms. Below test is performed with the non-dyed version of xPRO1100 but should be low risk to duplicate with xPRO1100-Black.

### Test Method and Specimens

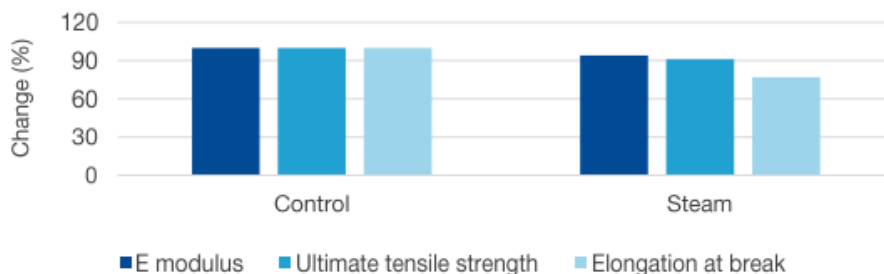
#### Steam Sterilization

Steam sterilization parameters	Settings
Vacuum pulses	4
Temperature	134°C
Pressure	210kPa
Holding time	4 minutes
Drying time	20 minutes

Testing conditions steam sterilization



## Mechanical Testing



*Change in mechanical properties after sterilization*

## Coloration



*Color samples before and after sterilization (with non-dyed version of xPRO1100)*

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