# 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 |
|---|---|---|---|---|---|---|
| **Tensile Properties** | | | | | | |
| Tensile Modulus | MPa | ASTM D638 | 2870 | 2990 | 2940 | 3010 |
| Tensile Strength at break | MPa | ASTM D638 | 67 | 73 | 72 | 71 |
| Elongation | % | ASTM D638 | 4.6 | 3.9 | 4.7 | 4 |
| **Thermal Properties** | | | | | | |
| HDT at 1.82 Mpa | °C | ASTM D648 | 61 | 72 | 69 | 93 |
| HDT at 0.45 Mpa | °C | ASTM D648 | 77 | 95 | 97 | 112 |
| **General Properties** | | | | | | |
| Viscosity at 25°C (77°F) | cP | ASTM D7867 | 280 | | | |
| Viscosity at 30°C (86°F) | cP | ASTM D7867 | 190 | | | |
| Liquid Density | $g/cm^3$ | ASTM D4052-18a | 1.11 | | | |
| Solid Density | $g/cm^3$ | ASTM D792 | 1.2 | | | |

## BASF Extended Properties

| Measurement | Unit | Test Method | Post Processed |
|---|---|---|---|
| **Flexural Properties** | | | |
| Flexural Modulus | MPa | ASTM D790 | 2790 |
| Flexural Stress | MPa | ASTM D790 | 125 |
| **Impact Properties** | | | |
| IZOD Impact (Notched) | J/m | ASTM D256 | 21 |
| Charppy (Notched) | $kJ/m^2$ | ISO179-1 | 1.11 |
| **Advanced Thermal Properties** | | | |
| Glass Transition Temperature (DMA, tan(d)) | °C | ASTM D4065 | 141 |
| Degradation temperature (TGA, 5% mass loss, air) | °C | ISO11358 | 339 |
| **FST Properties** | | | |
| 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<br>GWFI: 650°C |
| **Other Properties** | | | |
| Water Absorption (24hr) | % | ASTM D570 | 0.14 |
| Water Absorption (>2500hrs) | % | ASTM D570 | 2 |
| Shore Hardness | D | ASTM D2240 | 84 |

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# 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/m² | Narrowband (340 nm in W/(m²nm) | | | |
| 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*

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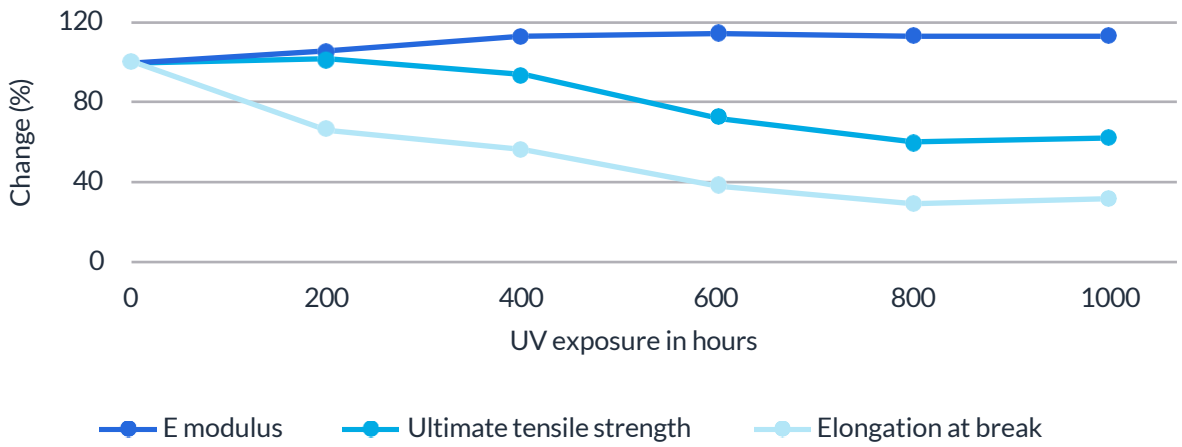
## Mechanical Testing




*Change in mechanical properties after accelerated weathering*

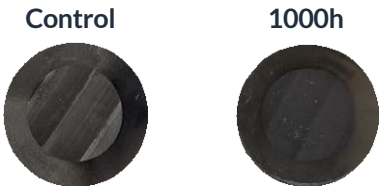
The final values after 1000 hours of long-term UV exposure can be found below.

| 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*

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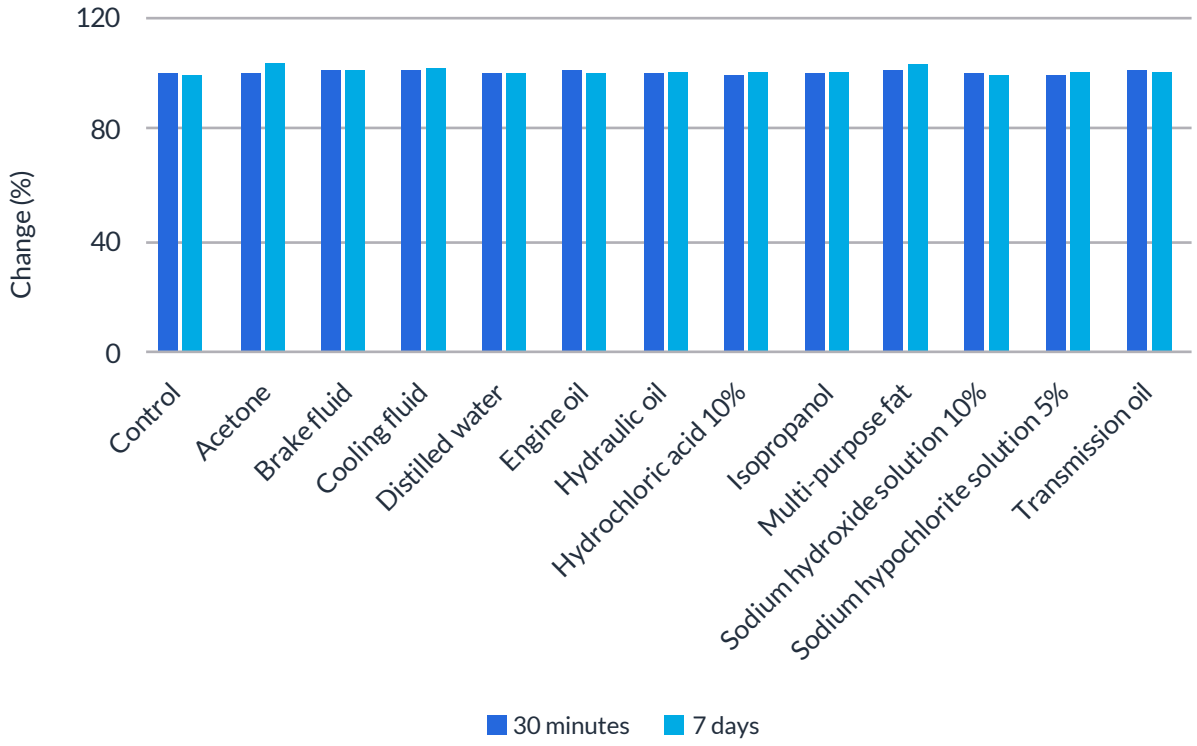
# Industrial Chemical Resistance

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*

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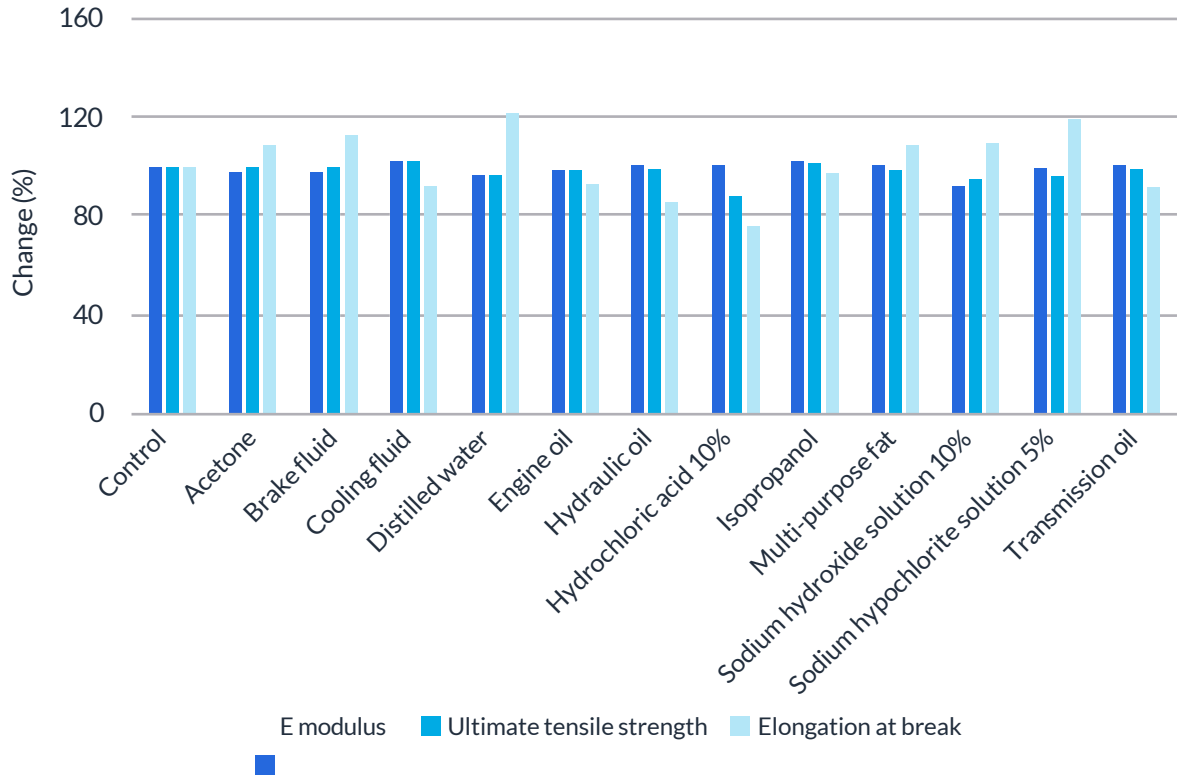
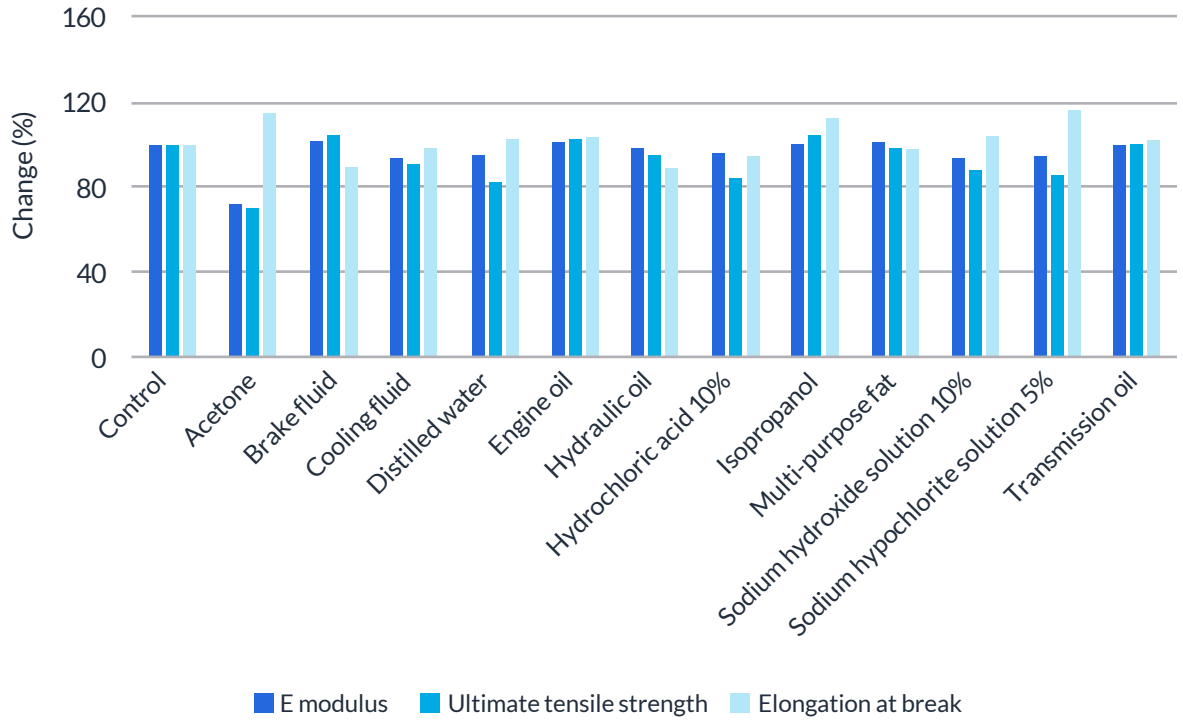
## Mechanical Testing

30 minutes




*Change in mechanical properties after 7 days immersion*

7 days




*Change in mechanical properties after 7 days immersion*

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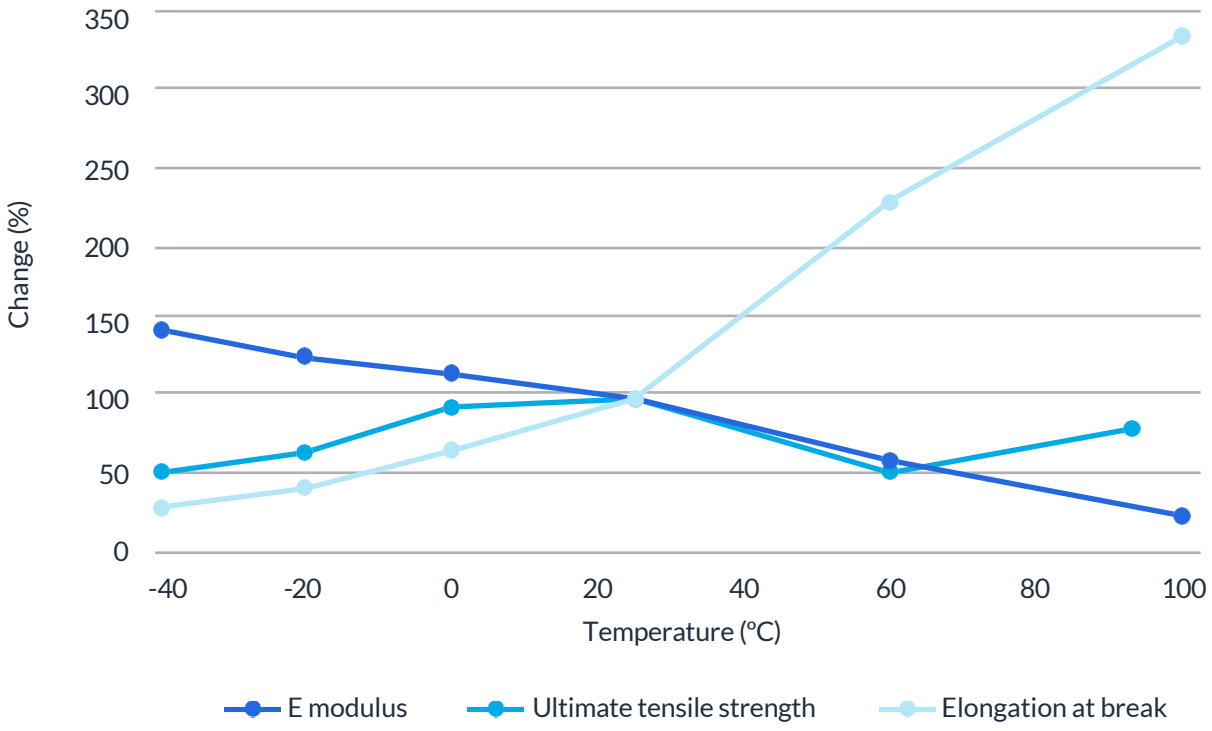
# Temperature Dependence of Mechanical Properties

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*

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# 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.

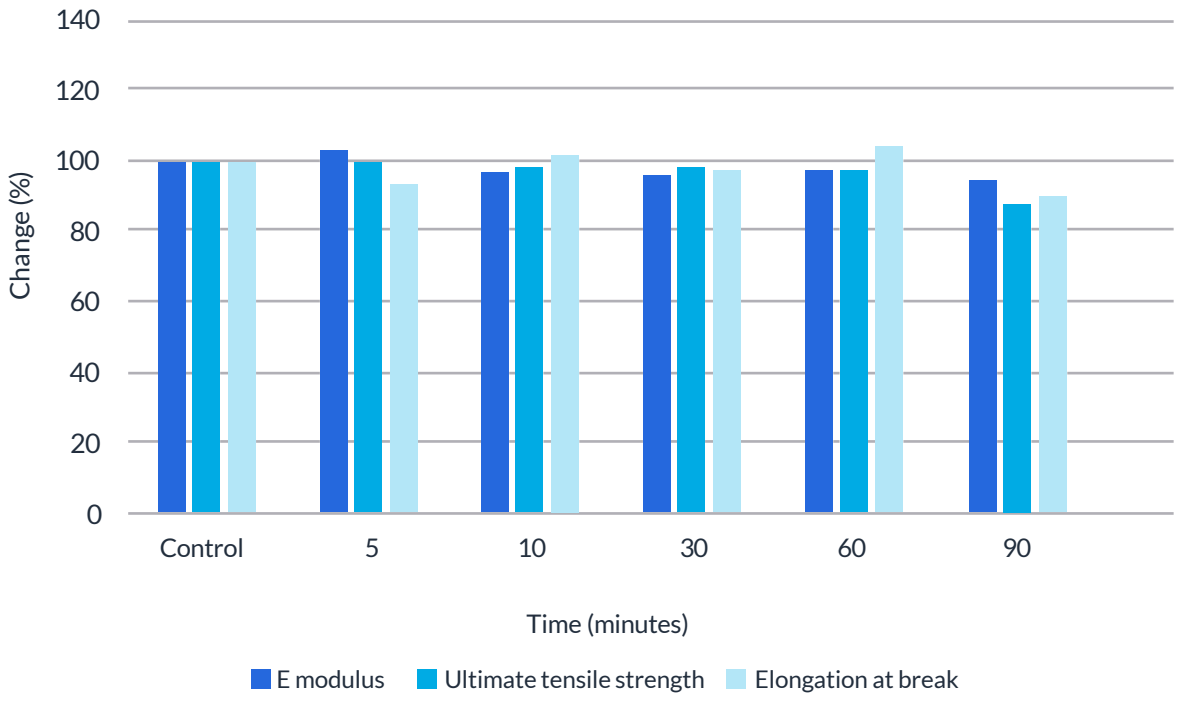
## Test Method and Specimens

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*

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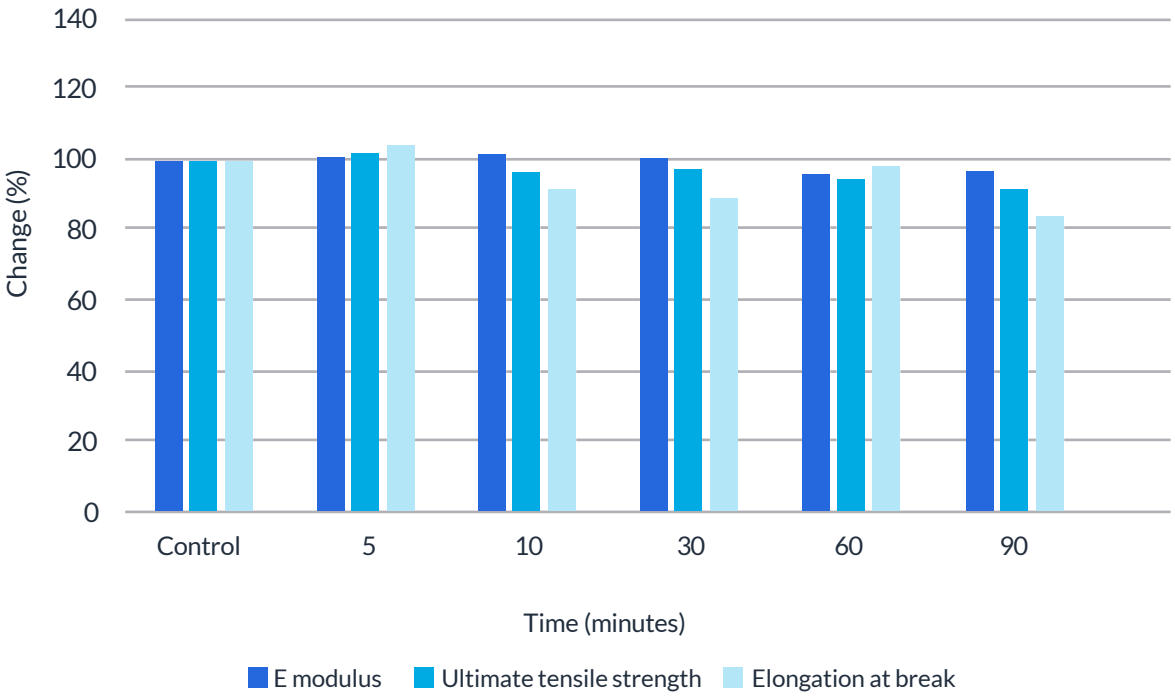


*Change in mechanical properties, 90°C*

# 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*

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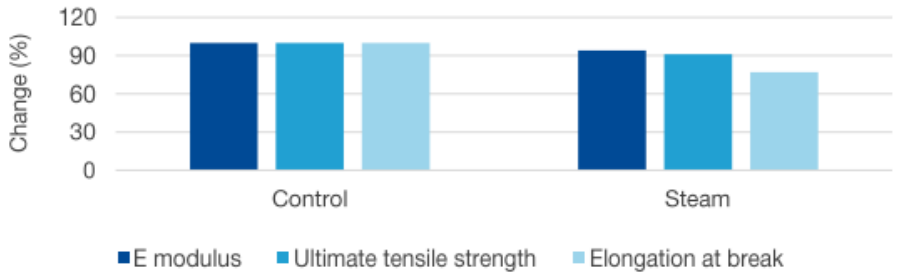
## Mechanical Testing




*Change in mechanical properties after sterilization*

## Coloration


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

**Note:** The information provided in this Technical Data Sheet (TDS) including the recommendations for use and application of the product are based on our knowledge and experience of the product as at the date of this TDS. The product can have a variety of different applications as well as differing application and working conditions in your environment that are beyond our control. Nexa3D is, therefore, not liable for the suitability of our product for the production processes and conditions in respect of which you use them, as well as the intended applications and results. We strongly recommend that you carry out your own prior trials to confirm such suitability of our product.

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