

**LOCTITE®**



*Picture provided by Stratasys*

# **LOCTITE® 3D 3172™**

HDT50 High Impact  
Photoplastic  
Gray

**LOCTITE®**

Henkel Corporation

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# LOCTITE®

## 3172™

HDT50 HIGH IMPACT  
PHOTOPLASTIC  
GRAY



## LOCTITE 3D 3172™

LOCTITE 3D 3172 is a durable photopolymer resin that enables functional parts production where high stiffness with a good surface finish and high impact resistance are required. Parts manufactured with this resin can be machined, tapped or polished.

LOCTITE 3D 3172 is compatible with a broad range of DLP machines.



### Benefits:

- Tough & durable
- Superior impact strength
- Nice surface finish, machine-able



### Ideal for:

- Manufacturing aids / Jigs & Fixtures
- Housings
- Insoles



### Markets:



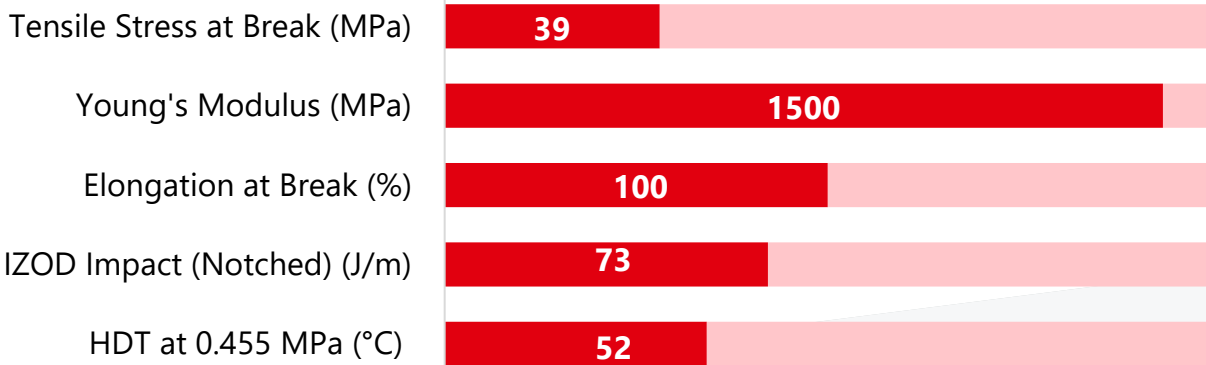
General Industry



Automotive



Consumer Goods



*\*Values shown are linked to LOCTITE 3D 3172 GY as reference, please refer to the specific mechanical properties for each of the colors shown in this document*



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## PROPERTIES

| Mechanical Properties    | Measure           | Method      | Green                   | Post Processed                             |
|--------------------------|-------------------|-------------|-------------------------|--|
| Tensile Stress at Break  | MPa               | ASTM D638   | 32 ± 1 <sup>[1]</sup>   | 39 ± 2 <sup>[2]</sup>                      |
| Tensile Stress at Yield  | MPa               | ASTM D638   | 22 ± 1 <sup>[1]</sup>   | 34 ± 1 <sup>[2]</sup>                      |
| Young's Modulus          | MPa               | ASTM D638   | 909 ± 36 <sup>[1]</sup> | 1494 ± 18 <sup>[2]</sup>                   |
| Elongation at Break      | %                 | ASTM D638   | 148 ± 5 <sup>[1]</sup>  | 105 ± 14 <sup>[2]</sup>                    |
| Flexural Strain at Break | %                 | ASTM D790   | -                       | >5 <sup>[16]</sup>                         |
| Flexural Modulus         | MPa               | ASTM D790   | -                       | 1080 ± 27 <sup>[16]</sup>                  |
| <b>Other Properties</b>  |                   |             |                         |  |
| IZOD Impact (Notched)    | J/m               | ASTM D256   | -                       | 73 ± 6 <sup>[3]</sup>                      |
| HDT at 0.455 MPa         | °C                | ASTM D648   | -                       | 51 ± 0.7 <sup>[4]</sup>                    |
| Shore Hardness (3s)      | D                 | ASTM D2240  | 57 <sup>[5]</sup>       | 63 <sup>[6]</sup>                          |
| Water Absorption (24 hr) | %                 | ASTM D570   | -                       | 1.4 – 1.6 <sup>[7]</sup>                   |
| Water Absorption (72 hr) | %                 | ASTM D570   | -                       | 2.4 – 2.6 <sup>[7]</sup>                   |
| Solid Density            | g/ml              | ASTM D792   | -                       | 1.0 – 1.4 <sup>[15]</sup>                  |
| Thermal Conductivity     | mW/(m-K)          | ASTM D5930  | -                       | 199 <sup>[8]</sup>                         |
| Heat Capacity            | J/(g-K)           | ASTM D5930  | -                       | 1.7 ± 0.1 <sup>[8]</sup>                   |
| CTE                      | µm/(m-K)          | ASTM E831   | -                       | 171 ± 4 <sup>[11]</sup>                    |
| <b>Biocompatibility</b>  |                   |             |                         |  |
| Cytotoxicity             |                   | ISO10993-5  |                         | Comply <sup>[12]</sup>                     |
| Irritation               |                   | ISO10993-23 |                         | Comply <sup>[13]</sup>                     |
| <b>Liquid Properties</b> |                   |             |                         |  |
| Viscosity at 25°C (77°F) | cP                | ASTM D7867  |                         | 1700 <sup>[9]</sup> - 2000 <sup>[14]</sup> |
| Liquid Density           | g/cm <sup>3</sup> | ASTM D1475  |                         | 1.1 <sup>[10]</sup>                        |

### Test Parameter

\*All specimen are printed unless otherwise noted. All specimen were conditioned in ambient lab conditions at 19-23°C / 40-60% RH for at least 24 hours." ASTM Methods: D638 Type IV, 50 mm/min, D790-B, 2 mm/min, D648, D256 Notched IZOD (Machine Notched), 6 mm x 12 mm, D570 0.125" x 2" Disc 24hr@ 25°C, D2240, Type "D" (0, 3 seconds), D7867, D1475  
\*The biological assessment has been performed based on the in vitro method according to ISO10993-23

### Internal Data Sources:

[1] FOR21293, [2] FOR21199, [3] FOR19120, [4] FOR19863, [5] FOR19123, [6] FOR19124, [7] FOR216114, [8] FOR26233, [9] FOR49798, [10] FOR19122, [11] FOR25783, [12] FOR40642, [13] FOR52815 (in-vitro), [14] FOR73299, [15] FOR219425, [16] FOR342022



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## WORKFLOW

Validated workflows need to be followed to achieve properties as provided in the TDS. Examples of validated workflow steps are listed below. Users should defer to the most current workflow information for best results which can be found at <https://www.loctiteam.com/printer-validation-settings>

## PRINTER SETTINGS

LOCTITE 3D 3172 GY is formulated to print optimally on industrial DLP printer. Read the safety data sheet carefully to get details about health and safety instructions. Recommended print parameters:

- Shake resin bottle well before usage
- Temperature: 20°C to 35°C
- Intensity: 1 mW/cm<sup>2</sup> to 7 mW/cm<sup>2</sup>

| Settings: 405nm at 2.4 mW/cm <sup>2</sup> | Measure | Method   | Value |
|---|---------|----------|-------|
| Layer Thickness                           | µm      | Internal | 100   |
| First Layer                               | s       | Internal | 45    |
| Burn in Region                            | s       | Internal | 6     |
| Model Layer Cure Time                     | s       | Internal | 7     |

| Settings: 385 nm at 5 mW/cm <sup>2</sup> | Measure            | Method   | Value                |
|--|--------------------|----------|----------------------|
| E <sub>c</sub>                           | mJ/cm <sup>2</sup> | Internal | 5.35 <sup>[16]</sup> |
| D <sub>p</sub>                           | mm                 | Internal | 0.25 <sup>[16]</sup> |

| Settings: 385 nm at 5 mW/cm <sup>2</sup> | Measure | Method   | Exposure time |
|--|---------|----------|---------------|
| D <sub>c</sub> =50um                     | s       | Internal | 3.8*          |
| D <sub>c</sub> =100um                    | s       | Internal | 4.3*          |

**Test Parameter**

\*Exposure times are calculated without a safety factor

**Internal Data Sources:**

[16] FOR43451



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## WORKFLOW

Validated workflows need to be followed to achieve properties as provided in the TDS. Examples of validated workflow steps are listed below. Users should defer to the most current workflow information for best results which can be found at <https://www.loctiteam.com/printer-validation-settings>

## CLEANING

LOCTITE 3D 3172 GY requires cleaning to achieve specified properties. Prior to post curing, support structures should be removed from the printed part, and the part should then be washed. Use compressed air to remove residual solvent from the surface of the material between intervals.

| Post Process Step       | Agent | Method            | Duration | Intervals | Additional Info                      |
|-------------------------|-------|-------------------|----------|-----------|--------------------------------------|
| Cleaning                | IPA   | Ultrasonic        | 2.5 min  | 2         | Allow parts to dry between intervals |
| Dry                     | n.a.  | Compressed air    | 20 s     | 2         | Air pressure (55psi)                 |
| Wait before post curing | n.a.  | Ambient condition | 60 min   | 1         | Room temperature                     |

## POST CURING

LOCTITE 3D 3172 GY requires post curing to achieve specified properties. It is recommended that either an LED or wide spectrum lamp be used to post cure parts.

| UV Curing Unit      | UV Source                         | Intensity                        | Cure time per side | Additional Settings (Shelf, Output Energy) |
|---------------------|-----------------------------------|----------------------------------|--------------------|--|
| Loctite CL36        | 405nm LED                         | 80 mW/cm <sup>2</sup> at 405 nm  | 20 min             | 100% top & side, rotary table              |
| Dymax 5000 EC Flood | Mercury Arc Bulb (broad spectrum) | 150 mW/cm <sup>2</sup> at 380 nm | 10 min             | Shelf I                                    |

## STORAGE

Store LOCTITE 3D 3172 GY in the unopened container in a dry location. Optimal storage: 8°C to 30°C, storage below 8°C or greater than 30°C can adversely affect products properties. More specific information is given in the Safety Data Sheet. Material removed from container may be contaminated during use. For this reason, filter used resin with 190µm mesh filter before placing back into proper storage container.





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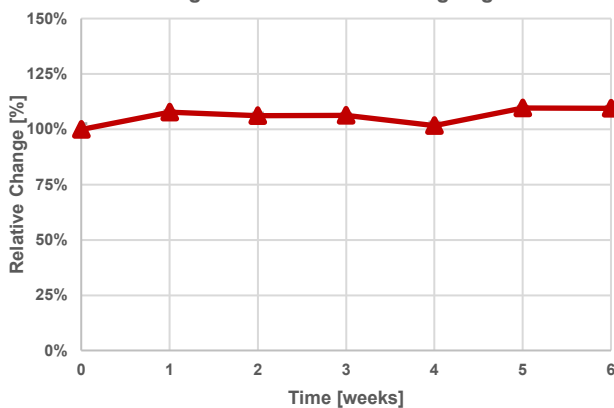
### AGEING AND ENVIRONMENTAL EFFECTS – HEAT AGEING

LOCTITE 3D 3172 GY was heat aged without load according to ASTM D3045. Test samples were exposed for a defined time at 50°C and conditioned for 24 hours at 22°C before mechanical testing. Control samples were stored at a constant 22°C. All samples were printed in the same print job using a validated workflow. Mechanical testing was conducted according to ASTM D638 at standard lab conditions (22°C).

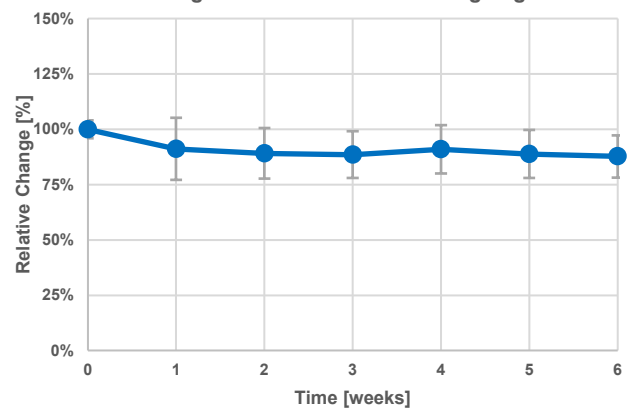
“0 weeks” represents non-aged samples stored at 22°C and tested 24 hours after post-processing.

Based on temperature dependence of reaction rates a test time of 6 weeks at 50°C can be interpreted as approximately 12 months at ambient temperature.

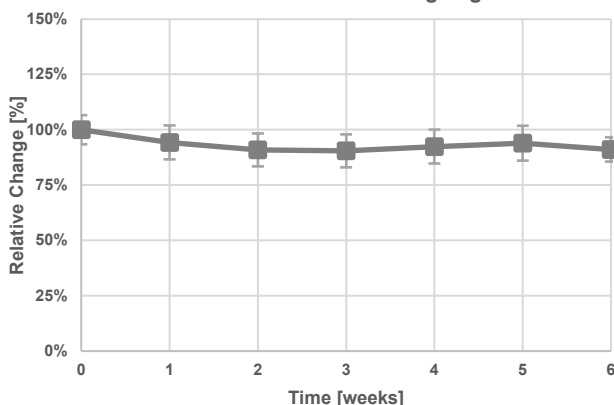
Young's Modulus after Heat Ageing at 50°C



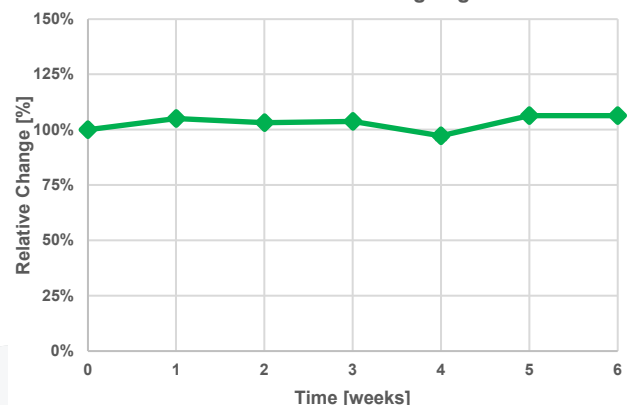
Elongation at Break after Heat Ageing at 50°C



Stress at Break after Heat Ageing at 50°C



Stress at Yield after Heat Ageing at 50°C



**Test parameters:**

ASTM D638: Type IV, Pull speed: 50 mm/min, Young's modulus measured at 0.1-1.0% (regression), 22°C

Internal Data Sources:  
[FOR91998](#), [FOR91999](#)



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## 3172™

HDT50 HIGH IMPACT  
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GRAY

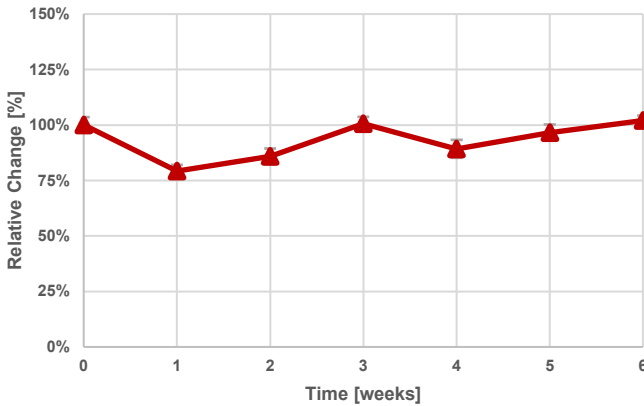


### AGEING AND ENVIRONMENTAL EFFECTS – ACCELERATED WEATHERING (UV AGEING)

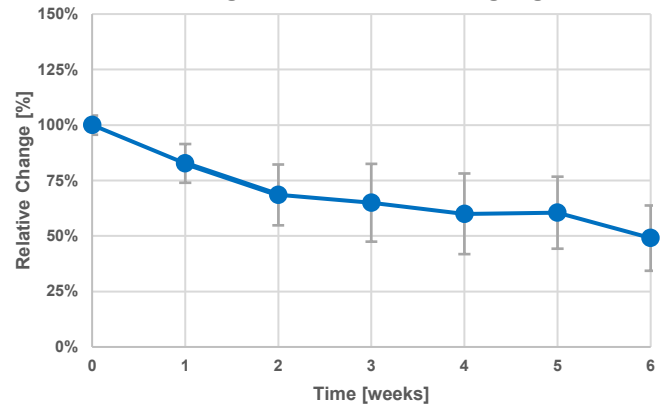
LOCTITE 3D 3172 GY has been tested after accelerated outdoor weathering according to ASTM D4329 (Cycle A). Test samples were exposed to defined conditions of heat, water condensation and UV light. Exposed samples were conditioned for 24 hours at 22°C before mechanical testing. Control samples were stored at a constant 22°C. All samples were printed in the same print job using a validated workflow. Mechanical testing was conducted according to ASTM D638 at standard lab conditions (22°C). "0 weeks" represents non-aged samples stored at 22°C and tested 24 hours after post-processing.

Please note, accelerated weathering testing can never fully represent real outdoor conditions and complexity. It is therefore recommended to conduct additional (outdoor) testing relevant for your specific application needs.

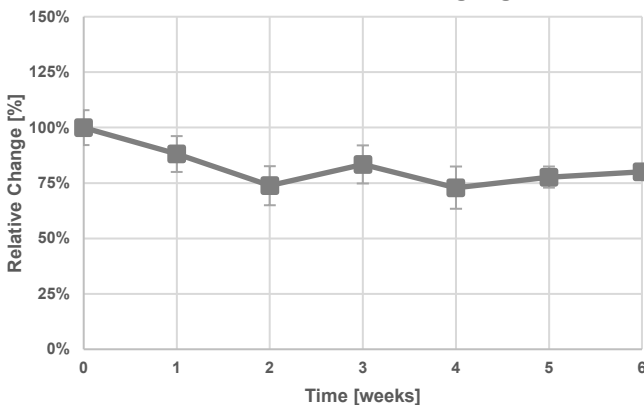
Young's Modulus after UV Ageing



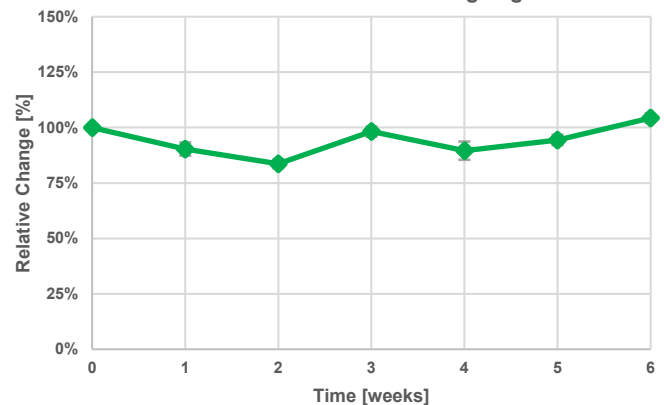
Elongation at Break after UV Ageing



Stress at Break after UV Ageing



Stress at Yield after UV Ageing



#### Test parameters:

ASTM D638: Type IV, Pull speed: 50 mm/min, Young's modulus measured at 0.1-1% (regression), 22 °C

ASTM D4329: cycle A for general applications, QUV/se, UVA 340 nm, 0.89 W/m<sup>2</sup>·nm, 8 hours UV light at 60°C followed by 4 hours at 50°C condensation in the dark. To reduce any sample warpage during test time samples were placed in tailor-made holders without any fixation clamps or mechanical load. Exposed samples were always removed from QUV before next condensation cycle to avoid samples that are soaked excessively with water before testing.

#### Internal Data Sources:

[FOR137761](#), [FOR137766](#)



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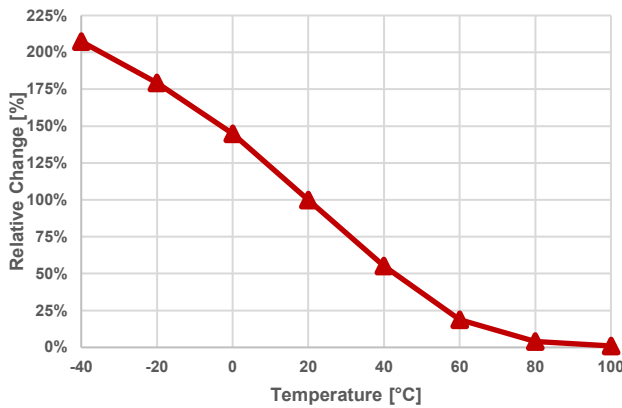
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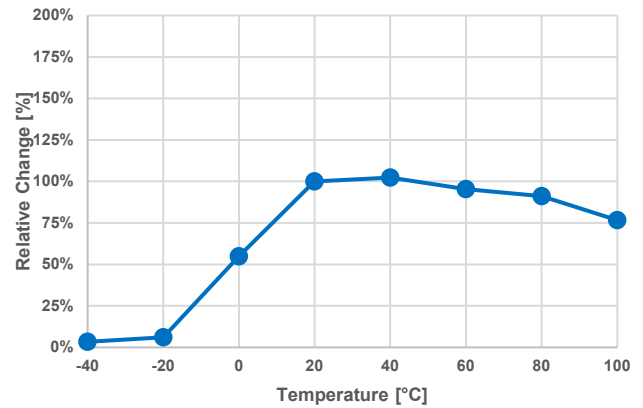
### THERMAL INFLUENCE ON MECHANICAL PROPERTIES

LOCTITE 3D 3172 GY has been tested according to ASTM D638 at varied environmental temperatures, from -40°C to 100°C. All samples were printed in the same print job using a validated workflow. Mechanical testing was conducted according to ASTM D638. Before each test series samples were conditioned for 60 minutes at the specific test temperature.

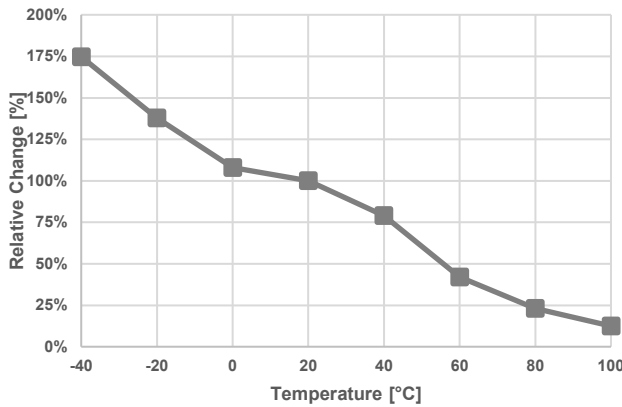
Young's Modulus at -40°C to 100 °C



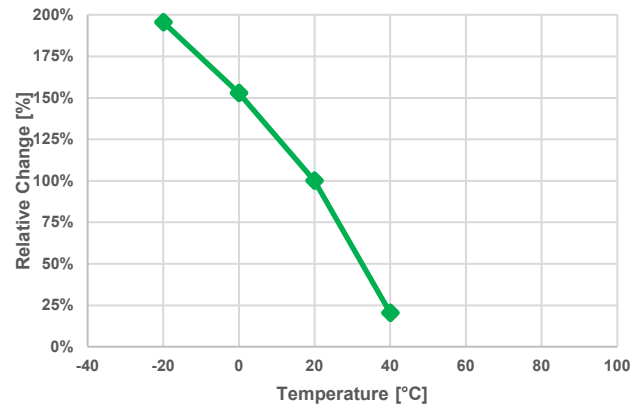
Elongation at Break at -40°C to 100 °C



Stress at Break at -40°C to 100 °C



Stress at Yield at -40°C to 100 °C



Test parameters: ASTM D638, Type IV, Pull speed: 50 mm/min, Young's modulus measured at 0.1-1% (regression),

Internal Data Sources:  
[1] FOR176885







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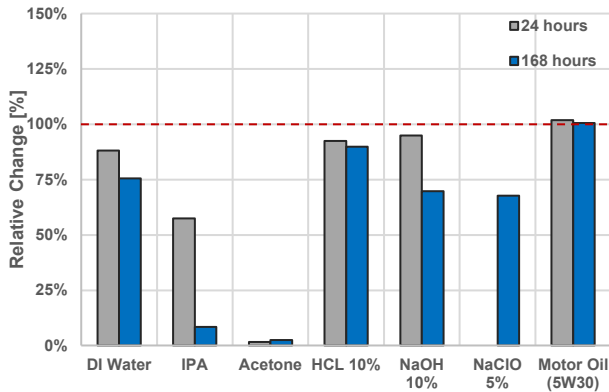
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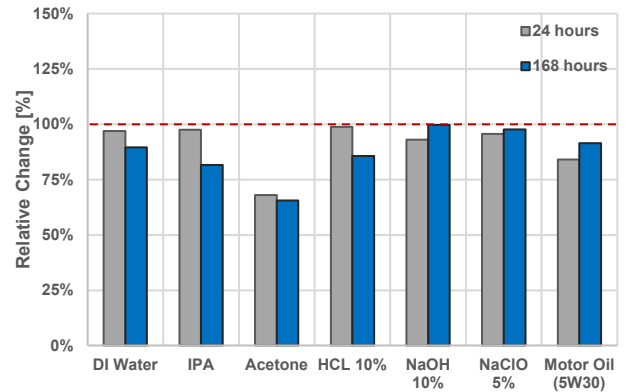
## AGEING AND ENVIRONMENTAL EFFECTS – CHEMICAL RESISTANCE (1/2)

LOCTITE 3D 3172 GY has been tested after chemical ageing according to ASTM D543. The influence of chemicals was tested by measuring mechanical properties after different test times (Immersion test for 24 and 168 hours). Exposed samples were stored in containers and fully immersed in different chemicals. Samples were stirred every 24 hours using a shaker. After removal, exposed samples were washed and conditioned for 24 hours at 22°C before mechanical testing. All samples were printed using a validated workflow. Mechanical testing was conducted according to ASTM D638 at standard lab conditions (22°C). 100% represents non-aged samples stored at 22°C and tested 24 hours after post-processing.

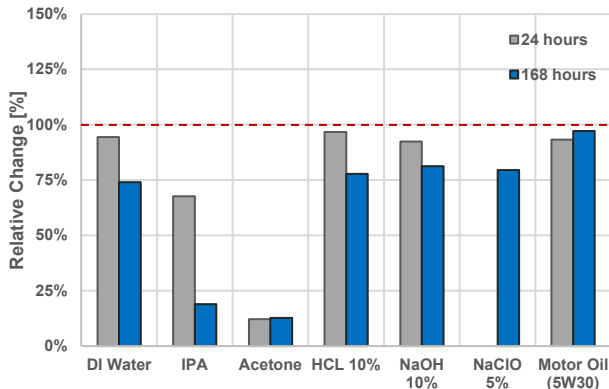
Young's Modulus after Immersion Time



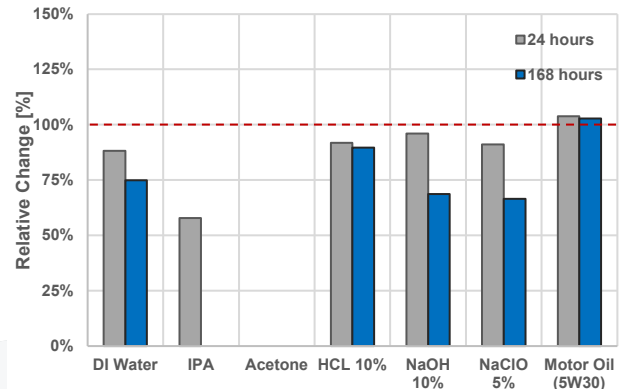
Elongation at Break after Immersion Time



Stress at Break after Immersion Time



Stress at Yield after Immersion Time



### Test parameters:

ASTM D638: Type IV, Pull speed: 50 mm/min, Young's modulus measured at 0.1-1.0% (regression), 22°C

ASTM D543: Samples immersed in different chemicals were stored at 22°C. Samples immersed in Motor Oil were stored at 50°C.

Properties of media used: pH(HCl, 10%) = 1; pH(NaOH, 10%) = 14; pH(NaClO, 5%) = 13

### Internal Data Sources:

[DI water] FOR344157, [IPA] FOR344161, [Acetone] FOR344163, [HCl 10 %] FOR344164, [NaOH 10 %] FOR351236, [NaClO 5 %] FOR351237, [5W30] FOR351238



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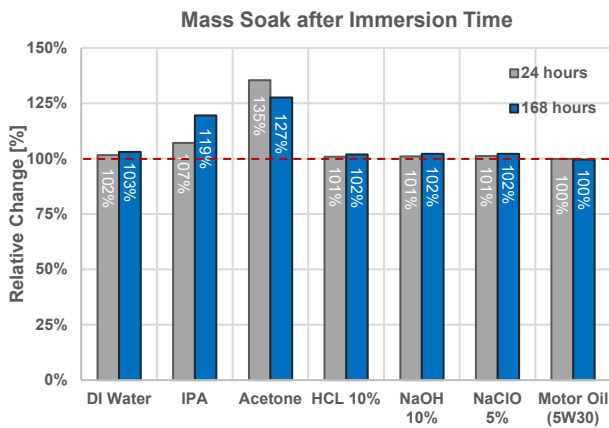
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### AGEING AND ENVIRONMENTAL EFFECTS – CHEMICAL RESISTANCE (2/2)

LOCTITE 3D 3172 GY has been tested after chemical ageing according to ASTM D543. The influence of chemicals was tested by measuring the mass change after different test times (Immersion test for 24 and 168 hours). Exposed samples were stored in containers and fully immersed in different chemicals. Samples were stirred every 24 hours using a shaker. After removal exposed samples were washed, dried and immediately weighed. All samples were printed using a validated workflow. "100%" represents the initial weight 24 hours after post-processing.



#### Test parameters:

ASTM D543: Samples immersed in different chemicals were stored at 22°C. Samples immersed in Motor Oil were stored at 50°C. Properties of media used: pH(HCl, 10%) = 1; pH(NaOH, 10%) = 14; pH(NaClO, 5%) = 13

#### Internal Data Sources:

[DI water] [FOR344197](#), [IPA] [FOR344282](#), [Acetone] [FOR344283](#), [HCl 10 %] [FOR344285](#), [NaOH 10 %] [FOR351240](#), [NaClO 5 %] [FOR351242](#), [5W30] [FOR351244](#)



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## NOTE

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