

LOCTITE®



Picture provided by Nexa3D

LOCTITE® 3D IND405™

HDT50 High Elongation

Photoplastic

Black, Clear

LOCTITE®

Henkel Corporation

loctite3dp@henkel.com





IND405™

HDT50 HIGH ELONGATION
PHOTOPLASTIC
BLACK, CLEAR



LOCTITE 3D IND405™

LOCTITE 3D IND405 is a rigid, high-strength, high elongation engineering material with outstanding impact resistance and excellent surface finish properties.

This stiff and durable high-performance material is ideal for a wide variety of tools in the production floor, including manufacturing aids and final parts such as housings and consumer goods applications.

Parts can be printed with various DLP printers and machined, tapped, or polished for final finish.



Benefits:

- High impact resistance with high elongation
- Easy to print (one-part material)
- Tough and Durable
- The toughest clear resin (only applicable for clear material)
- Functional Prototyping



Ideal for:

- Clear prototypes (clear version)
- Fluid routing & consumer goods prototypes
- Manufacturing aids/tools
- Housings



Markets:



Industry



Consumer Goods

Tensile Stress at Break (MPa)

52

Elongation at Break (%)

127

Young's Modulus (MPa)

1300

HDT at 0.455 MPa

53

IZOD Impact (Notched, J/m)

72

**Values shown are linked to LOCTITE IND405 Clear 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 Yield | MPa | ASTM D638 | 25 ± 1 ^[1] | 44 ± 1 ^[2] |
| Tensile Stress at Break | MPa | ASTM D638 | 24 ± 1 ^[1] | 45 ± 2 ^[2] |
| Tensile Modulus | MPa | ASTM D638 | 897 ± 20 ^[1] | 1,434 ± 80 ^[2] |
| Elongation at Break | % | ASTM D638 | 89 ± 9 ^[1] | 101 ± 11 ^[2] |
| Flexural Modulus | MPa | ASTM D790 | 826 ± 27 ^[10] | 1383 ± 63 ^[10] |
| Other Properties | | | | |
| HDT at 0.455 MPa | °C | ASTM D648 | - | 52.8 ^[3] |
| HDT at 1.82 MPa | °C | ASTM D648 | - | 43.4 ^[11] |
| IZOD Impact (Notched) | J/m | ASTM D256 | - | 51 ± 4 ^[4] |
| Water Absorption (24hr) | % | Internal | - | 1 ^[5] |
| Shore Hardness (3s) | D | ASTM D648 | - | 76 ^[6] |
| Solid Density | g/cm ³ | ASTM D1475 | 1.116 ^[7] | 1.121 ^[7] |
| CTE (-30°C to 45°C) | µm/(m·K) | ASTM E831 | - | 98.47 ^[9] |
| Liquid Properties | | Measure | Method | Value |
| Viscosity at 25°C (77°F) | cP | ASTM D7867 | | 2,200 – 2,400 ^[8] |
| Liquid Density | g/cm ³ | ASTM D1475 | | 1.046 ^[7] |

"All specimen are printed unless otherwise noted. All specimen were conditioned in ambient lab conditions at 19-23C / 40-60% RH for at least 24 hours." ASTM Methods: D638 Type IV, 50mm/min, D790-B, 2mm/min, D256 Notched IZOD (Machine Notched), 6 mm x 12 mm, D648, D2240, Type "D" (0, 3 seconds), D1475, D7867

Internal Data Sources:

[1] FOR19614, [2] FOR18201, [3] FOR18828, [4] FOR18611, [5] FOR18206, [6] FOR18207, [7] FOR18208, [8] FOR48490, [9] FOR76890 [10] FOR324512 [11] FOR215430





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PROPERTIES

| Electrical Properties | Measure | Method | Green | Post Processed |
|---------------------------------------------------------------|--------------|-----------|-------|----------------|
| Volume Resistivity | Ω -cm | ASTM D257 | - | 2.75E +15 [1] |
| Surface Resistivity | Ω | ASTM D257 | - | 7.79E +15 [1] |
| Dielectric Strength | kV/mm | ASTM D149 | - | 24.9 [2] |
| AC Relative Permittivity (Dielectric Constant) ^[3] | | | | |
| at 50 Hz (XY) | none | ASTM D150 | - | 4.7 |
| at 1 kHz (XY) | none | ASTM D150 | - | 4.2 |
| at 1 MHz (XY) | none | ASTM D150 | - | 3.6 |
| AC Loss Characteristic (Dissipation Factor) ^[3] | | | | |
| at 50 Hz (XY) | none | ASTM D150 | - | 0.017 |
| at 1 kHz (XY) | none | ASTM D150 | - | 0.014 |
| at 1 MHz (XY) | none | ASTM D150 | - | 0.150 |

Internal Data Sources:

[1] FOR106272 [2] FOR106273 [3] FOR106274





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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 IND405 BK is formulated to print optimally on industrial DLP printer. Read the safety data sheet carefully to get details about health and safety instructions.

- Shake resin bottle well before usage
- Temperature: 20°C to 35°C
- Intensity: 3 mW/cm² to 7 mW/cm²

Exposure time for an intensity of 5 mW/cm²

| | | | | | |
|---------------------------|----|----|-----|--------------------------------------|------|
| Layer Thickness (µm): | 25 | 50 | 100 | E _c (mJ/cm ²) | 6.1 |
| First layer time (s) | 15 | 25 | 45 | D _p (mm): | 0.14 |
| Burn in region (s): | 8 | 15 | 30 | | |
| Model Layer Exposure (s): | 3 | 4 | 8 | | |

POST PROCESSING

LOCTITE 3D IND405 BK requires post processing 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 | Interval | Additional Info |
|-------------------------|-------|-------------------|------------|----------|----------------------|
| Cleaning | IPA | Orbital | 2.5 min | 2 | |
| Dry | n.a. | Compressed air | 10 to 60 s | 1 | Air pressure (30psi) |
| Wait before post curing | n.a. | Ambient condition | 60 min | 1 | Room temperature |





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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>

POST CURING

LOCTITE 3D IND405 Black 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 UVALOC 1000 | Mercury Vapor (H-bulb) | 30 mW/cm ² at 405 nm | 10 min | |
| Loctite CL36 | 405nm LED | 80 mW/cm ² at 405 nm | 20 min | 100% top & side |
| Uvitron Intelliray 600W | Mercury Arc Bulb (broad spectrum) | 66% Intensity | 10 min | |

STORAGE

Store **LOCTITE 3D IND405 Black** in the unopened container in a dry location. Optimal Storage: 8°C to 30°. Storage below 8°C or above 30°C can adversely affect product properties. Material removed from containers 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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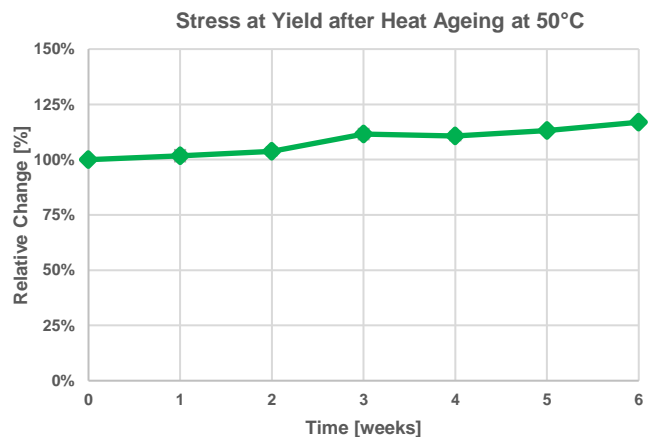
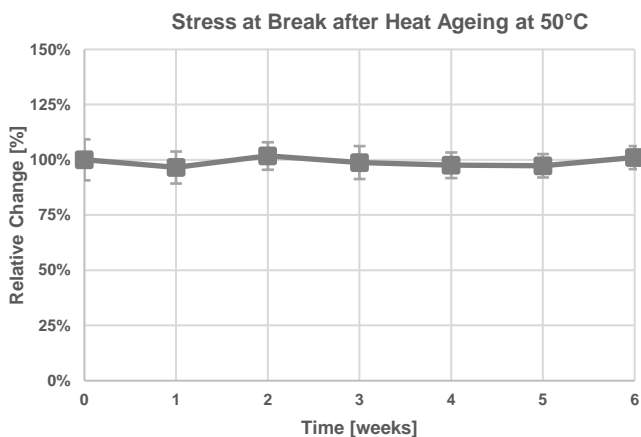
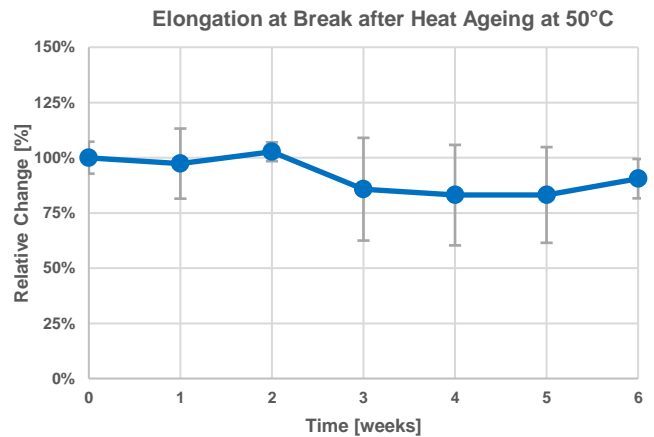
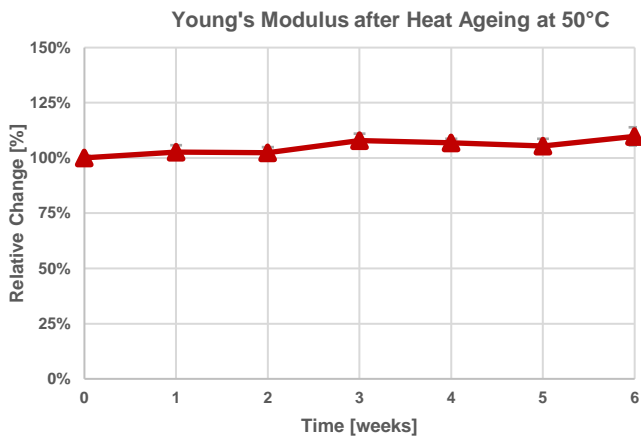


AGEING AND ENVIRONMENTAL EFFECTS – HEAT AGEING

LOCTITE 3D IND405 BK 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.



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:

FOR184762, FOR184774





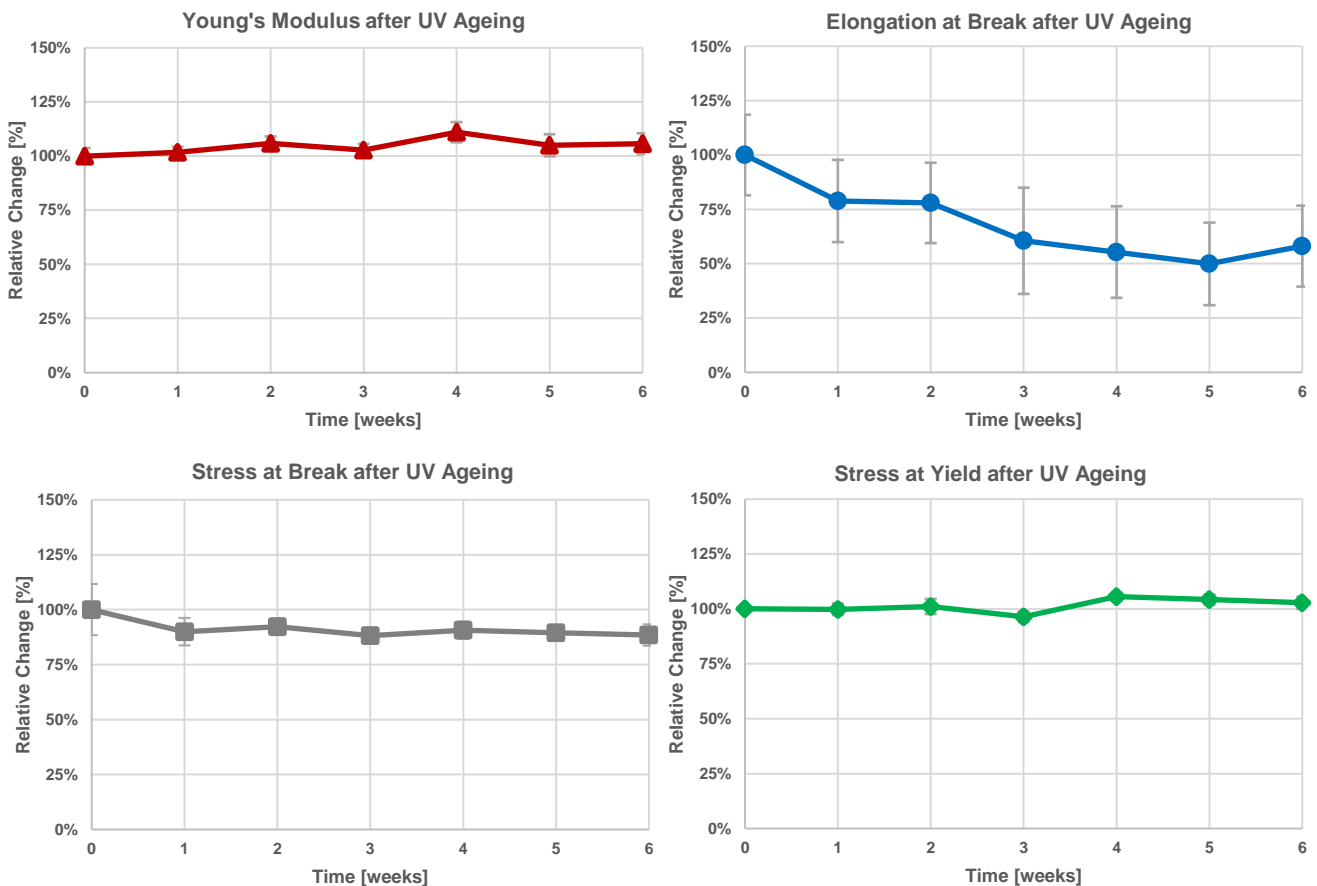
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AGEING AND ENVIRONMENTAL EFFECTS – ACCELERATED WEATHERING (UV AGEING)

LOCTITE 3D IND405 BK 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.



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/m2·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:
FOR176912, FOR176906





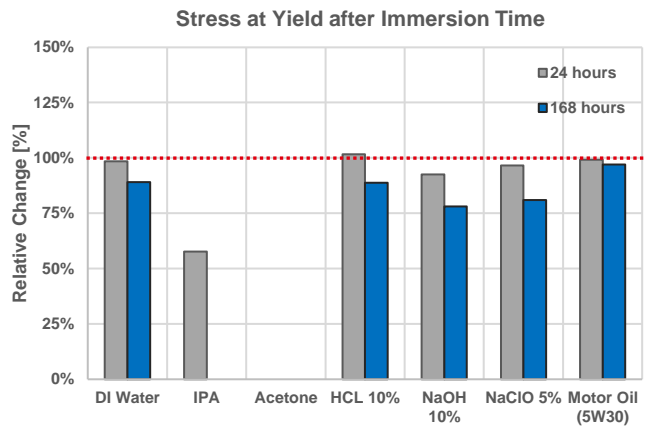
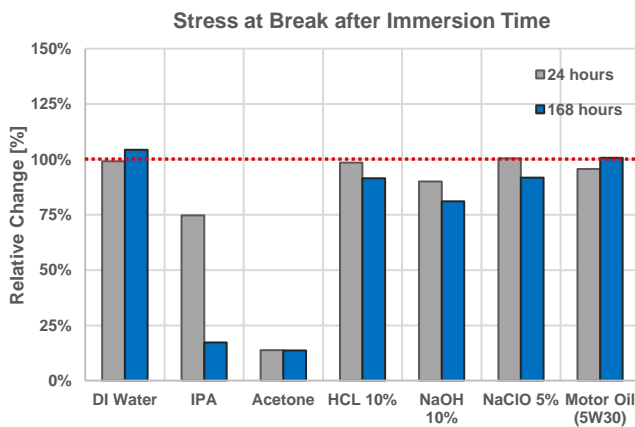
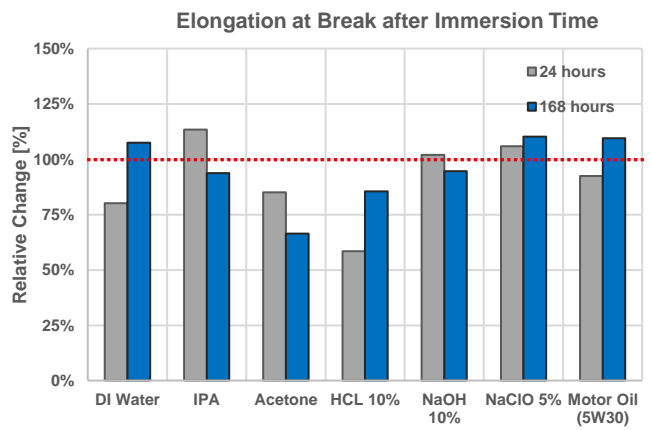
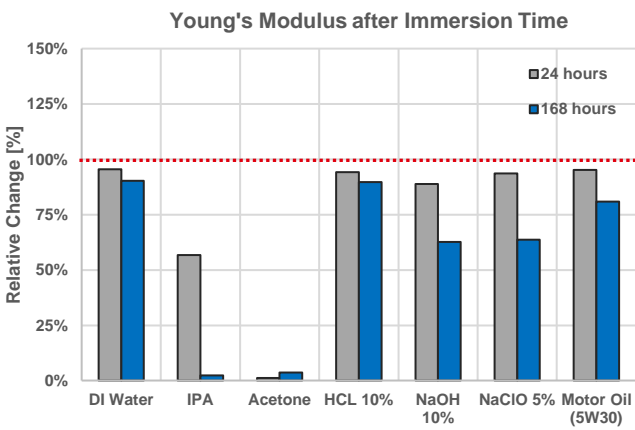
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AGEING AND ENVIRONMENTAL EFFECTS – CHEMICAL RESISTANCE (1/2)

LOCTITE 3D IND405 BK 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.



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.

Internal Data Sources:

[1] FOR198775, FOR199485, FOR199486, FOR199488, FOR203081, FOR203082, FOR203083



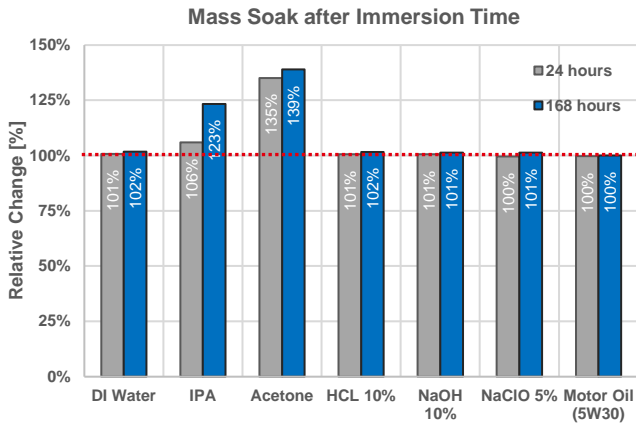


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AGEING AND ENVIRONMENTAL EFFECTS – CHEMICAL RESISTANCE (2/2)

LOCTITE 3D IND405 BK 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.

Internal Data Sources:

[1] FOR199489, FOR199490, FOR199491, FOR199492, FOR203084, FOR203085, FOR203086





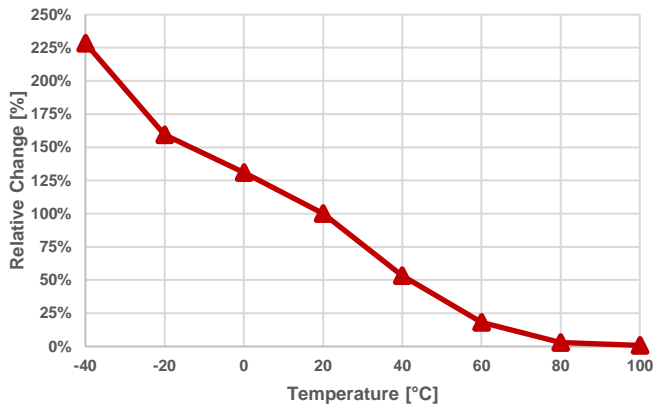
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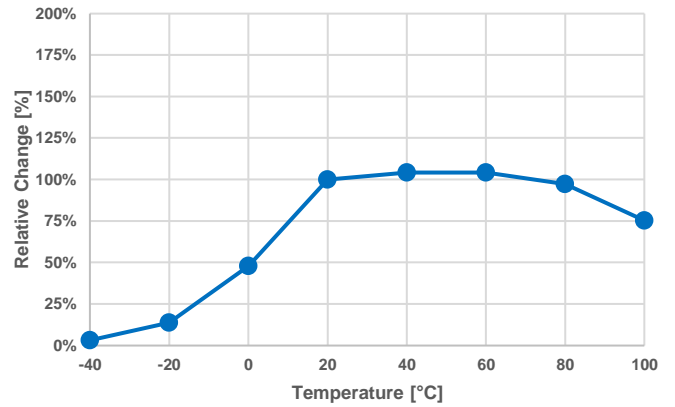
THERMAL INFLUENCE ON MECHANICAL PROPERTIES

LOCTITE 3D IND405 BK 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.

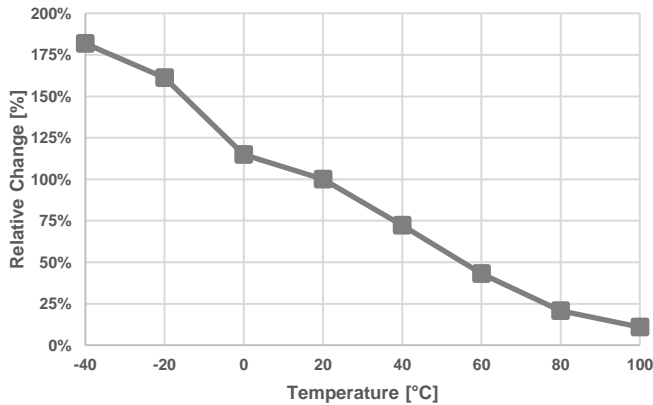
Young's Modulus at -40°C to 100°C



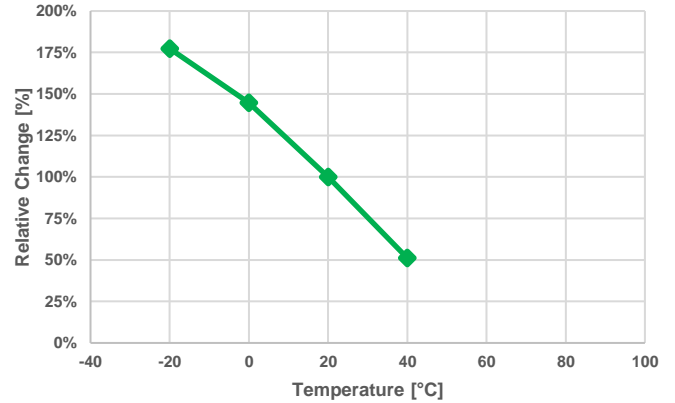
Elongation at Break at -40°C to 100°C



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:
FOR18878





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PROPERTIES

| Mechanical Properties | Measure | Method | Green | Post Processed |
|--------------------------------|-------------------|--------------|--------------------------|------------------------------|
| Tensile Stress at Yield | MPa | ASTM D638 | 23 ± 1 ^[1] | 39 ± 1 ^[2] |
| Tensile Stress at Break | MPa | ASTM D638 | 35 ± 3 ^[1] | 52 ± 3 ^[2] |
| Young's Modulus | MPa | ASTM D638 | 847 ± 26 ^[1] | 1,378 ± 41 ^[2] |
| Elongation at Break | % | ASTM D638 | 166 ± 14 ^[1] | 127 ± 6 ^[2] |
| Flexural Modulus | MPa | ASTM D790 | 884 ± 39 ^[12] | 1287 ± 57 ^[12] |
| Other Properties | | | | |
| HDT at 0.455 MPa | °C | ASTM D648 | - | 53 ^[3] |
| HDT at 1.82 MPa | °C | ASTM D648 | - | 46 ^[13] |
| IZOD Impact Strength (Notched) | J/m | ASTM D256 | - | 72 ± 2 ^[4] |
| Water Absorption (24hr) | % | Internal | - | 0.9 ^[5] |
| Shore Hardness (0s, 3s) | D | ASTM D2240 | - | 79, 76 ^[6] |
| Solid Density | g/cm ³ | ASTM D1475 | 1.126 ^[7] | 1.134 ^[7] |
| CTE (-30°C to 45°C) | µm/(m·K) | ASTM E831 | - | 91.14 ^[11] |
| Biocompatibility | | | | |
| Cytotoxicity | | ISO10993-5 | - | Comply ^[9] |
| Irritation | | ISO10993-23* | - | Comply ^[10] |
| Liquid Properties | | | | |
| Viscosity at 25°C (77°F) | cP | ASTMD7867 | | 2,100 - 2,300 ^[8] |
| Liquid Density | g/cm ³ | ASTMD1475 | | 1.050 ^[7] |

All specimen are printed unless otherwise noted. All specimen were conditioned in ambient lab conditions at 19-23C / 40-60% RH for at least 24 hours. ASTM Methods: D638 Type IV, 50mm/min, D790-B, 2mm/min, D256 Notched IZOD (Machine Notched), 6 mm x 12 mm, D648, D2240, Type "D" (0, 3 seconds), D1475, D7867

*The biological assessment has been performed based on the in vitro method according to ISO10993-23

Internal Data Sources:

[1] FOR19711, [2] FOR16273, [3] FOR18829, [4] FOR16321, [5] FOR16322, [6] FOR18476, [7] FOR17633, [8] FOR43175, [9] FOR40216, [10] FOR52782 (in-vitro), [11] FOR76865 [12] FOR324513 [13] FOR367581, FOR367589





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PROPERTIES

| Electrical Properties | Measure | Method | Green | Post Processed |
|---------------------------------------------------------------|--------------|-----------|-------|--------------------------|
| Volume Resistivity | Ω -cm | ASTM D257 | - | 8.55E +14 ^[1] |
| Surface Resistivity | Ω | ASTM D257 | - | 1.24E +15 ^[1] |
| Dielectric Strength | kV/mm | ASTM D149 | - | 27.4 ^[2] |
| AC Relative Permittivity (Dielectric Constant) ^[3] | | | | |
| at 50 Hz (XY) | none | ASTM D150 | - | 4.4 |
| at 1 kHz (XY) | none | ASTM D150 | - | 4.2 |
| at 1 MHz (XY) | none | ASTM D150 | - | 3.8 |
| AC Loss Characteristic (Dissipation Factor) ^[3] | | | | |
| at 50 Hz (XY) | none | ASTM D150 | - | 0.025 |
| at 1 kHz (XY) | none | ASTM D150 | - | 0.017 |
| at 1 MHz (XY) | none | ASTM D150 | - | 0.428 |

Internal Data Sources:

[1] FOR106275 [2] FOR116477 [3] FOR106277





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CLEAR COLOR PROPERTIES

In order to assess clear properties, color variation is measured as Delta-E (dE) to define parts transmittance.

dE measures changes from L*a*b*C*h. The table below shows the color variation for two different workflows: Method: ASTM E308, Total Transmission

| Part State | L* | a* | b* | C* | h | dE |
|-------------------------------|--------|--------|-------|------|--------|------|
| Green / no post-processing | 92.425 | -1.205 | 2.195 | 2.5 | 118.74 | NA |
| Dymax 5000EC 5 minutes / side | 92.255 | -0.52 | 1.265 | 1.37 | 112.28 | 1.17 |
| Loctite CL36 60 min/side | 92.18 | -0.32 | 0.89 | 0.94 | 109.88 | 1.83 |

The table below shows color variation after ageing

A dE of 1.0 - 2.0 change is the smallest color difference, in average, that the human eye can perceive QUV exterior weathering conditions (ASTM G-154—Cycle 1): Clear color

Method: ASTM G-154—Cycle 1 & ASTM E308, Total Transmission

| QUV Exposure Time (Hrs) | L* | a* | b* | C* | h | dE |
|-------------------------|-------|-------|------|------|--------|------|
| 0 | 90.86 | -0.65 | 1.03 | 1.22 | 122.49 | NA |
| 240 | 91.06 | -0.47 | 1.42 | 1.49 | 108.47 | 0.47 |





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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 IND405 CL 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: 3 mW/cm² to 7 mW/cm²

Exposure time for an intensity of 5 mW/cm²

| | | | | | |
|---------------------------|----|----|-----|--------------------------|------|
| Layer Thickness (µm): | 25 | 50 | 100 | Ec (mJ/cm ²) | 6.2 |
| First Layer Time (s): | 10 | 20 | 40 | Dp (mm): | 0.15 |
| Burn In Region Time (s): | 6 | 12 | 25 | | |
| Model Layer Exposure (s): | 2 | 3 | 6 | | |

POST PROCESSING

LOCTITE 3D IND405 Clear requires post processing 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 | Manual | 2 min | 1 | |
| Dry | n.a. | Compressed air | 10 to 60 s | 1 | Air pressure (30psi) |
| Wait before post curing | n.a. | Ambient condition | 60 min | 1 | Room temperature |





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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>

POST CURING

LOCTITE 3D IND405 CL 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) |
|-------------------------|-----------------------------------|----------------------------------|--------------------|--------------------------------------------|
| Uvitron Intelliray 600W | Mercury Arc Bulb (broad spectrum) | 66% Intensity | 2 min | Shelf Second from Bottom |
| Dymax 5000 EC Flood | Mercury Arc Bulb (broad spectrum) | 148 mW/cm ² at 380 nm | 2 min | 400W, Shelf K |
| Loctite CL36 | 405nm LED | 80 mW/cm ² at 405 nm | 10 min | 100% top & side |

POST PROCESSING OPTIONS

Polishing/ Clear Coating is needed for optimum clarity to be obtained. The following steps can be used as initial guidance, the exact steps and method will be determined by the end user's requirements:

1. Mark both sides of the printed object with a black ink or an available guide coating material.
2. Using 240 grit sandpaper, evenly sand the surface in an opposing 45-degree angle pattern until the surface has been fully sanded and the guide coat has been removed.
3. Remove sanding dust and any other debris from the surface of the part before proceeding.
4. Repeat steps 1 through 3 stepping up the numerical grit size: 400, 600, 800 and finishing at a buffing compound until the surface is smooth and has achieved the desired level of clarity.
5. Optional step: After using the above sanding method through grit size 800, thoroughly clean the surface of the part removing all dust and debris. Using multiple light coats of a high quality automotive clear coat, coat the surface of the printed part. Once the clear coating has fully cured buff the surface as needed to achieve the desired level of clarity.

Color/Dyeing - Laboratory testing shows that dyeing LOCTITE 3D IND405 CL using solvent solutions is possible. In order to maintain mechanical properties, we recommend dyeing after post cure is completed. Dyeing prior to post cure, results may vary and effect mechanical properties.

STORAGE

Store LOCTITE 3D IND405 Clear in the unopened container in a dry location. Optimal Storage: 8°C to 30°. Storage below 8°C or above 30°C can adversely affect product properties. Material removed from containers may be contaminated during use. For this reason, filter used resin with 190µm mesh filter before placing back into proper storage container.





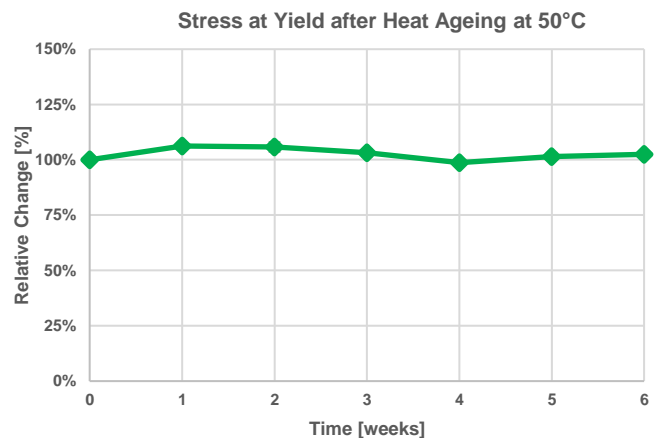
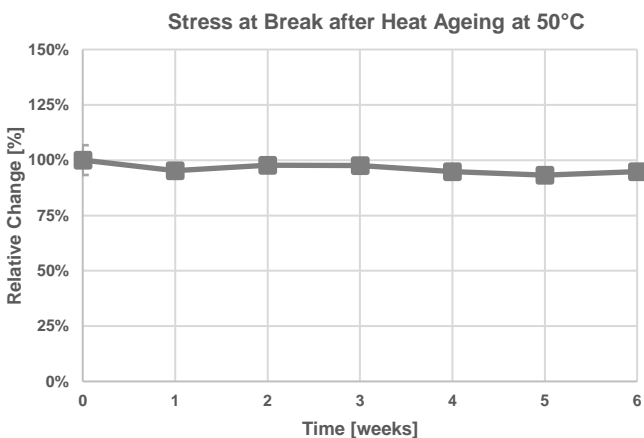
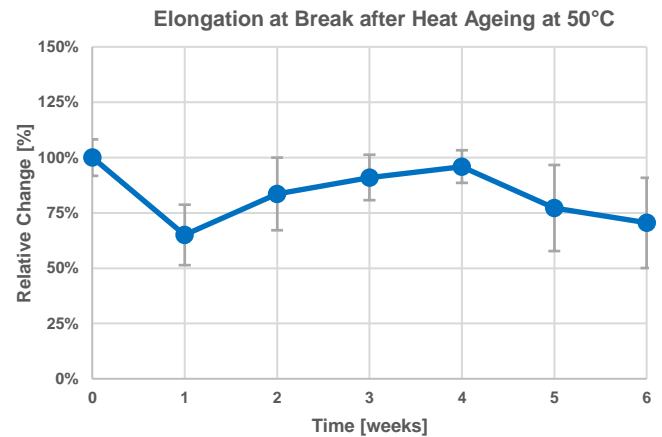
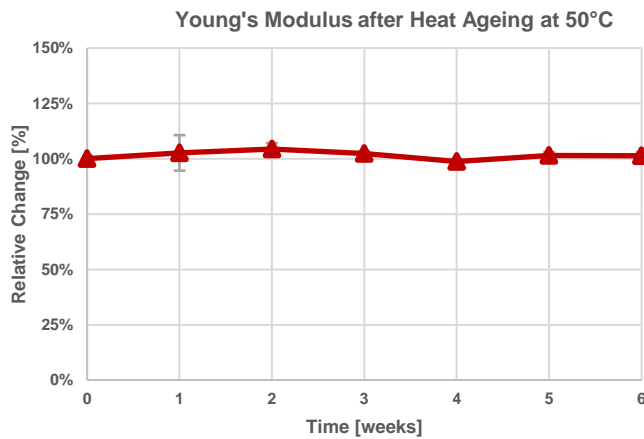
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AGEING AND ENVIRONMENTAL EFFECTS – HEAT AGEING

LOCTITE 3D IND405 CL 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.



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:

FOR104794, FOR104795





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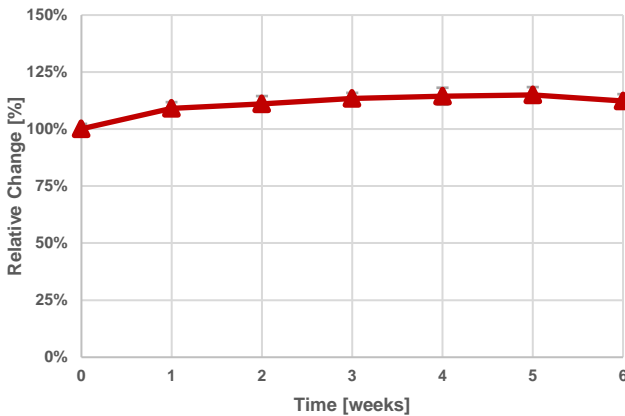


AGEING AND ENVIRONMENTAL EFFECTS – ACCELERATED WEATHERING (UV AGEING)

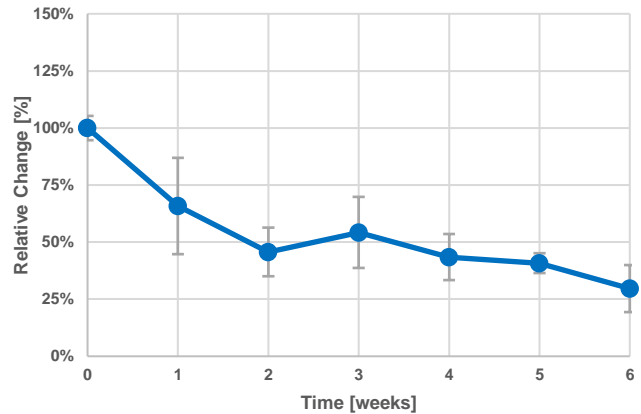
LOCTITE 3D IND405 CL has been tested after accelerated outdoor weathering according to ASTM D4329 (Cycle A). Test samples were exposed to defined conditions of heat, water condensation and UV light. Exposed samples were conditioned for 24 hours at 22°C before mechanical testing. Control samples were 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.

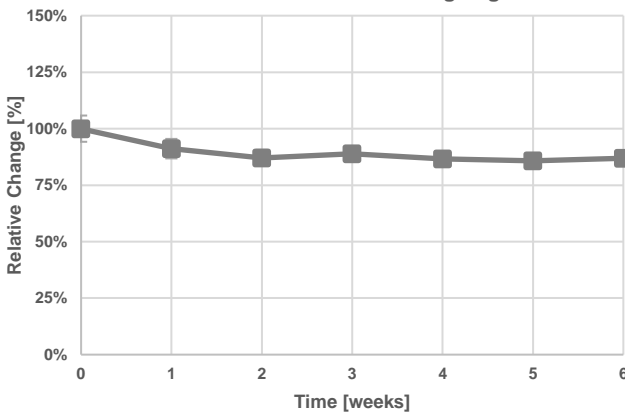
Young's Modulus after UV Ageing



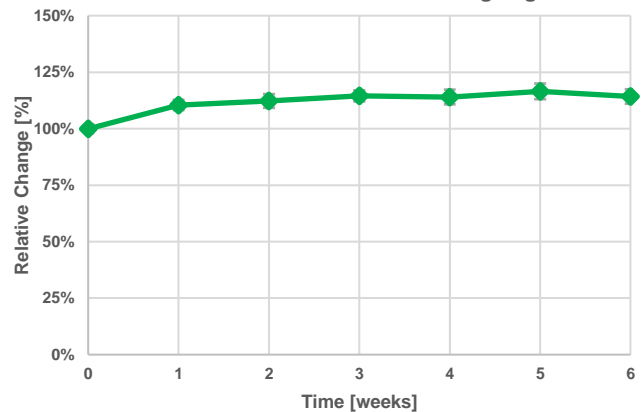
Elongation at Break after UV Ageing



Stress at Break after UV Ageing



Stress at Yield after UV Ageing



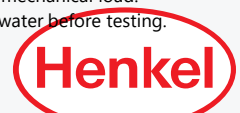
Test parameters:

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/m²-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:
FOR143233, FOR143235





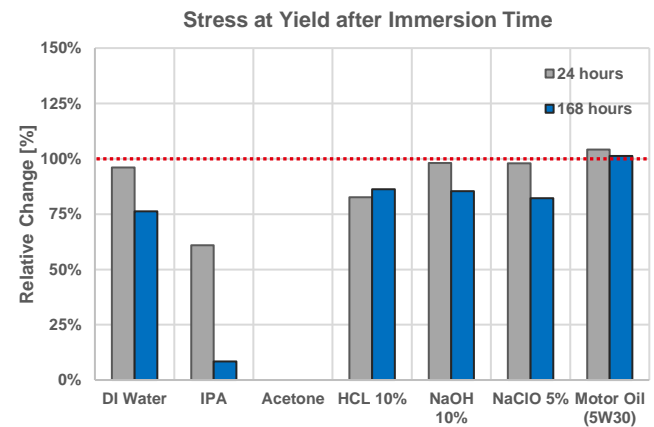
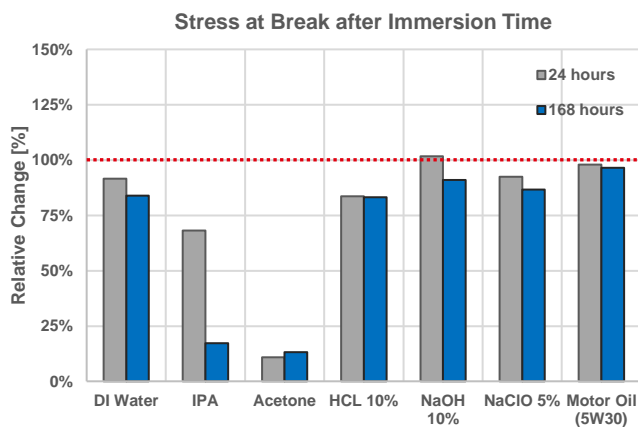
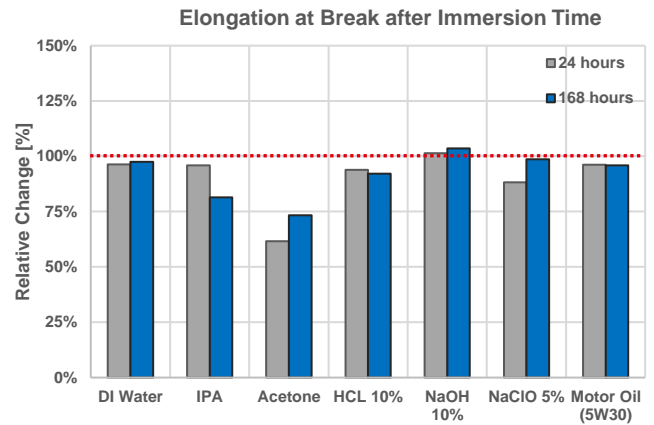
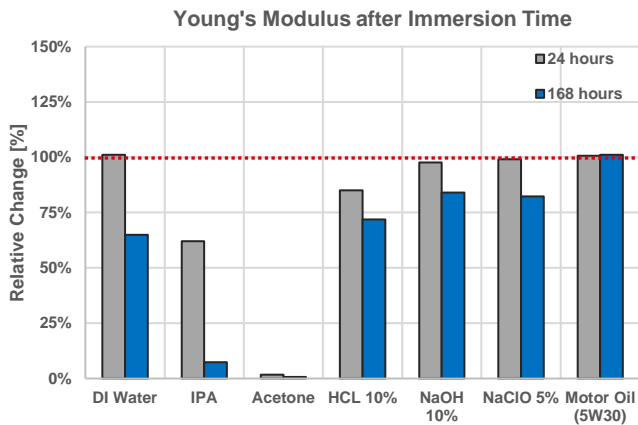
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AGEING AND ENVIRONMENTAL EFFECTS – CHEMICAL RESISTANCE (1/2)

LOCTITE 3D IND405 CL 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.



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

Internal Data Sources:

FOR208490, FOR208504, FOR208506, FOR208514, FOR213130, FOR213134, FOR213138





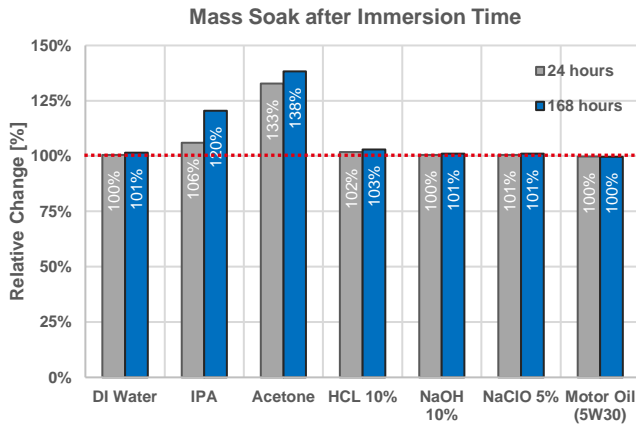
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AGEING AND ENVIRONMENTAL EFFECTS – CHEMICAL RESISTANCE (2/2)

LOCTITE 3D IND405 CL 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

Internal Data Sources:

FOR208521, FOR208522, FOR208523, FOR208524, FOR213142, FOR213143, FOR213145





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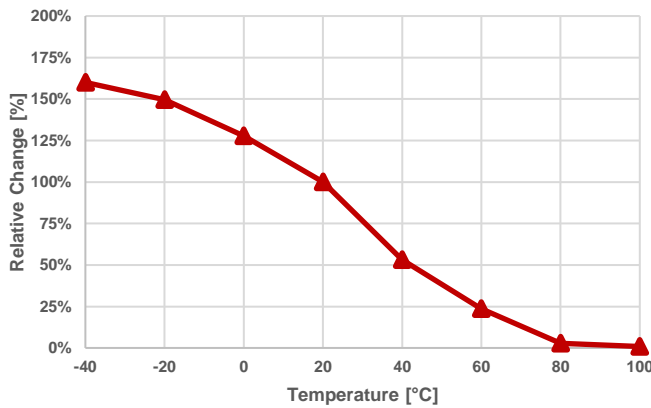
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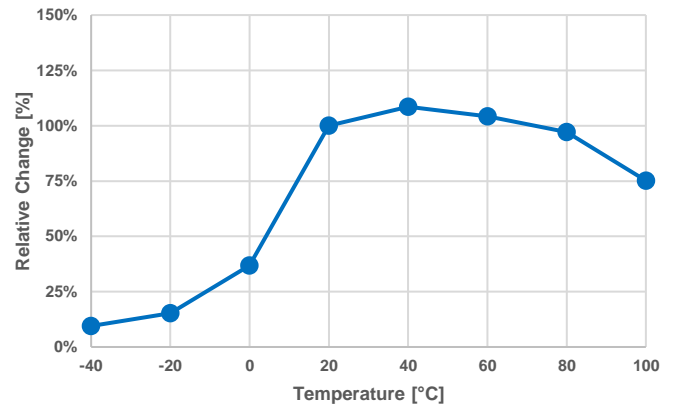
THERMAL INFLUENCE ON MECHANICAL PROPERTIES

LOCTITE 3D IND405 CL 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.

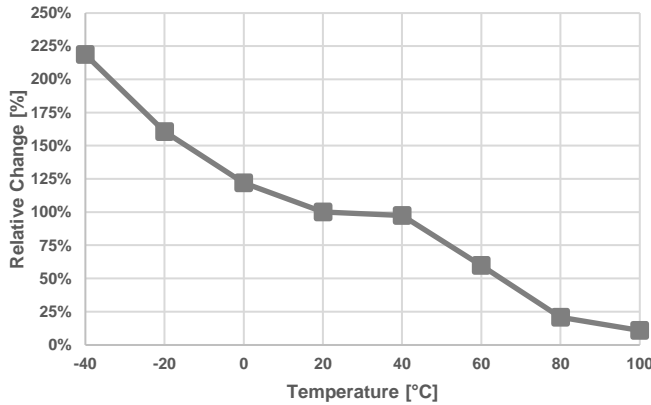
Young's Modulus at -40°C to 100°C



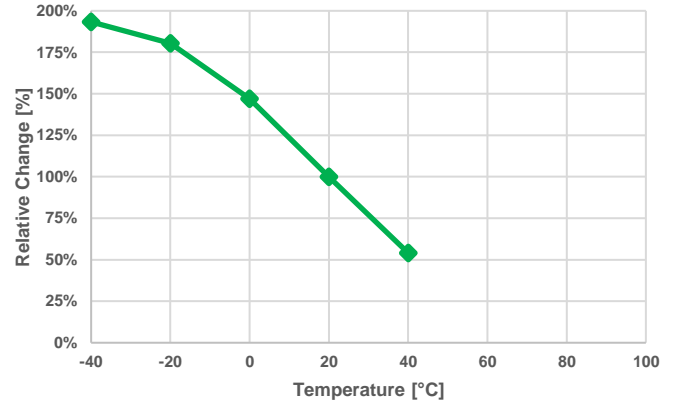
Elongation at Break at -40°C to 100°C



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:

FOR176839



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