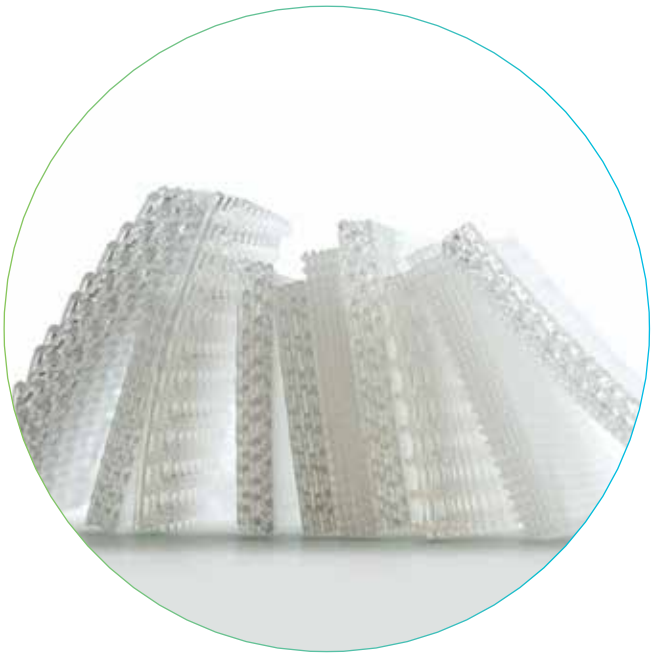
Liquid Silicone Rubber for additive manufacturing

Liquid Silicone Rubbers (LSRs) for additive manufacturing from NuSil® offer unique rheological properties for use in extrusion based additive manufacturing for a variety of applications. Historically, LSRs have been molded into parts, commonly through liquid injection molding. Printable LSRs allow for lab scale prototyping of complex geometries without compromising on the physical properties of the resulting material. Low volume production of customized parts can also be achieved with our printable materials.



CURE CHEMISTRY

NuSil's printable LSRs are addition cured, 2-part systems that are optimized for low temperature vulcanization. This platinum curing chemistry does not produce volatile leaving groups and results in minimal shrinkage of the printed part. Additionally, no steps are needed after curing to remove byproducts. NuSil offers dimethyl and diphenyl LSR options with various physical properties.

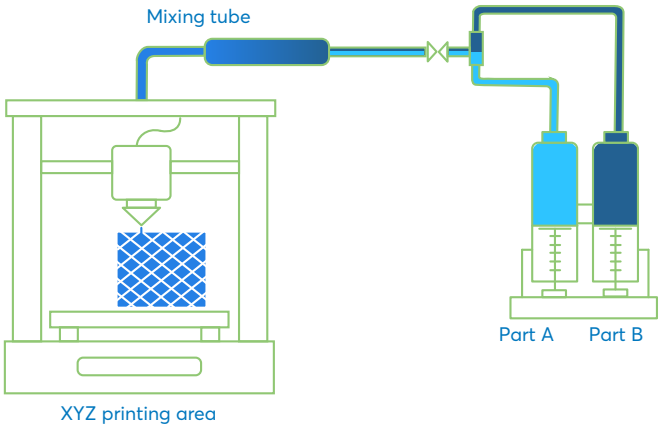


TABLE 1: TYPICAL UNCURED AND CATALYZED PROPERTIES FOR PROCESSING

Typical Properties	LSR-1	LSR-2	LSR-3	LSR-4
Uncured:				
Viscosity Part A	3,000,000 cP at 0.1 s^{-1}, 830,000 cP at 1 s^{-1}	10,200,000 cP at 0.1 s^{-1}, 140,000 cP at 1 s^{-1}	1,100,000 cP at 0.1 s^{-1}, 370,000 cP at 1 s^{-1}	2,500,000 cP at 0.1 s^{-1}, 350,000 cP at 1 s^{-1}
Extrusion Rate, Part A	8.27 g/min	9 g/min	16 g/min	23 g/min
Viscosity Part B	710,000 cP at 0.1 s^{-1}, 120,000 cP at 1 s^{-1}	7,200,000 cP at 0.1 s^{-1} 1,150,000 cP at 1 s^{-1}	4,500,000 cP at 0.1 s^{-1}, 650,000 cP at 1 s^{-1}	3,700,000 cP at 0.1 s^{-1} 470,000 cP at 1 s^{-1}
Extrusion Rate, Part B	28.80 g/min	9 g/min	24 g/min	16 g/min
Appearance	Translucent	Translucent	Translucent	Translucent
Mixed (1:1 A:B Ratio)				
Viscosity	2,500,000 cP at 0.1 s^{-1}, 360,000 cP at 1 s^{-1}	4,600,000 cP at 0.1 s^{-1}, 700,000 cP at 1 s^{-1}	3,200,000 cP at 0.1 s^{-1}, 480,000 cP at 1 s^{-1}	3,500,000 cP at 0.1 s^{-1}, 500,000 cP at 1 s^{-1}
Yield Point (modulus crossover)	350 Pa	500 Pa	415 Pa	510 Pa
Work Time	>5 hours	72 hours	>24 hours	>72 hours
Cure Rate T90 m @ 80 °C	6 min	16 min	14 min	30 min
Cure Rate T90 m @ 100 °C	1.5 min	2 min	2 min	6 min

LSR-1 and LSR-2 are dimethyl, and LSR-3 and LSR-4 are diphenyl.

TABLE 2: CURED PROPERTIES OF MATERIAL

Typical Properties	LSR-1	LSR-2	LSR-3	LSR-4
Cured*: 30 min at 100 °C, 2 hours at 150 °C				
Specific Gravity	1.10	1.13	1.14	1.17
Durometer, Type A	25	40	35	60
Tensile Strength	600 psi (4.1 MPa)	1,000 psi (6.9 MPa)	530 psi (3.7 MPa)	700 psi (4.8 MPa)
Elongation	475%	520%	300%	230%

LSR-1 and LSR-2 are dimethyl, and LSR-3 and LSR-4 are diphenyl.

*Cured properties of standard molded slab

NuSil's printable LSR materials are in pilot lifecycle and available for sampling, allowing for quick commercialization or customization depending upon end-application requirements.

www.avantorsciences.com/nusil

To learn more about NuSil LSRs for additive manufacturing, visit: **avantorsciences.com/nusil** or contact a NuSil expert at **silicone@avantorsciencesgcc.com** or **+ 1 805 684 8780**

It is the sole responsibility of each purchaser to ensure that any use of these materials is safe and complies with all applicable laws and regulations. It is the user's responsibility to adequately test and determine the safety and suitability for their applications, and NuSil Technology LLC makes no warranty concerning fitness for any use or purpose.

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