RESiFA™ SOLESPHERE

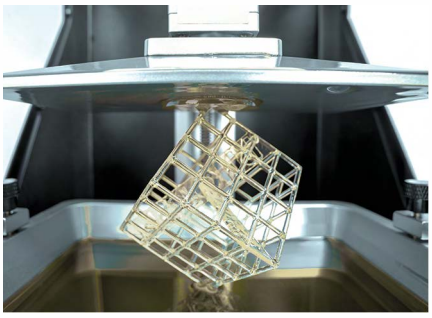
AGC

Fine Microspherical Silica for 3D Printing Resins / Additive Manufacturing

AGC offers a family of fine silica with different particle sizes and porosities under the trade name **SOLESPHERE™**. These fine silica are very spherical, very pure and provide many functionalities for 3D printing resin formulations.

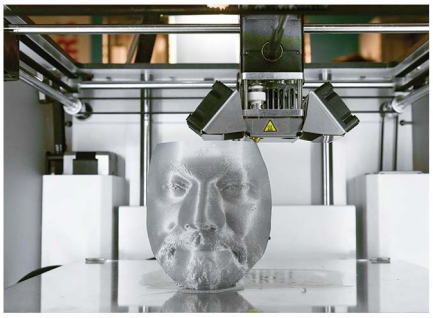
Additive Manufacturing

Additive Manufacturing, also known as 3D printing, is the process of creating solid three-dimensional objects, layer by layer, with the use of computer design modeling. This process drastically reduces prototype costs and time to market. This field is rapidly growing, and specialty fillers are needed to reach higher performance levels. SOLESPHERE™ silica provide solutions to enhance product quality, increase property performance and improve processing efficiencies. The 3D Printing processes can be categorized into three groups. The most common method is photopolymerization.



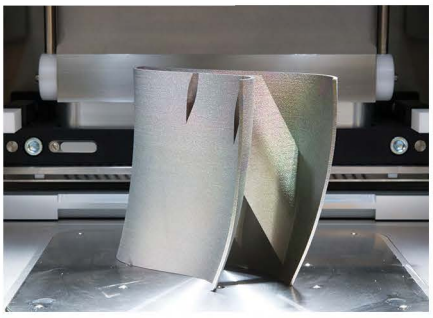
Photopolymerization

- Stereolithography (SL/SLA)
- Digital Light Processing (DLP)



Material Extrusion

- Fused Deposition Modeling (FDM)
- Fused Filament Fabrication (FFF)



Powder Bed Fusion

- Powder bed
- Inkjet head 3D printing (3DP)
- Electron Beam Melting (EBM)
- Selective Laser Sintering/Melting (SLS/SLM)

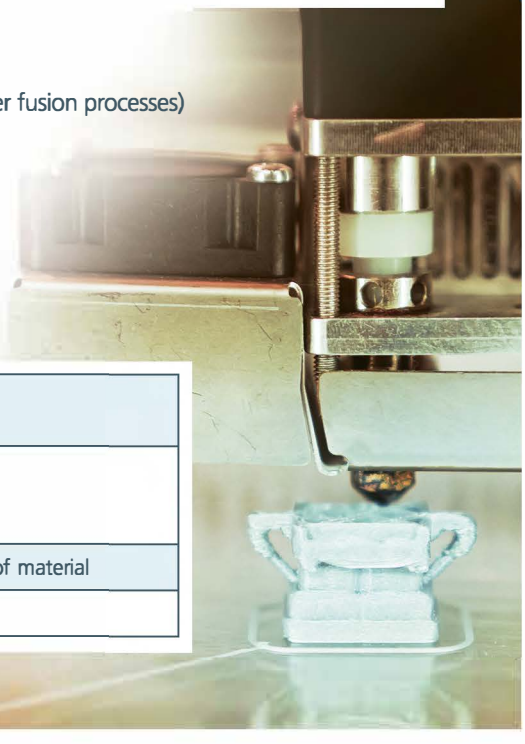
SOLESPHERE™ Benefits

- Higher tensile strength
- Increase in stiffness / flexural strength
- Improved dimensional stability
- Spacers (prevents blocking of soft polymer in powder fusion processes)
- Easily dispersible in polymer matrix
- Thermal resistant / improved HDT

Physical Properties

SOLESPHERE™ silica offer several advantages as a filler material for 3D resin formulations.

>99% Purity	Impurities can have an effect on viscosity, physical properties, and may alter chemical/physical interactions in the polymer matrix
Spherical Shape Large Particle Size Low Surface Areas	All helps to reduce viscosity in the final formulation
Particle Size Distribution	Low particle size distribution provides consistent results for each batch of material
Active Chemical Surface	Allows good chemical bonding/interactions with resins and other fillers

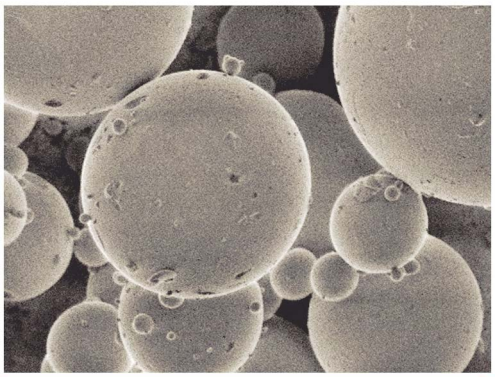


Mitigate Viscosity and Sedimentation

Silica loadings in 3D resin formulations can range from 3-50% by weight. Highly filled resin formulations present two major challenges: viscosity and sedimentation. The physical properties of SOLESPHERE™ help mitigate these two major concerns.

Viscosity control - Initial viscosity and viscosity stability: Higher filler loadings typically mean higher viscosities. Higher viscosity systems decrease workability and processing speeds. SOLESPHERE™ silica have a very spherical and smooth surface. In addition, the narrow particle size distribution minimizes fine particle content of less than 1um compared to other silica offerings. These factors contribute to viscosity control/lower viscosity when compared to other filler options. SOLESPHERE™ also forms a matrix with typical 3D printing resins and other additives keeping the constituents in suspension which provides good viscosity stability over time.

Anti-settling: Phase separation is another problem faced with 3D printing systems. During storage or idle time, heavier additives will tend to settle downward while lighter components will migrate to the top. The surface chemistry of SOLESPHERE™ is very functional and provides a network within the polymer matrix. This matrix helps in the prevention of phase separation and settling during storage.



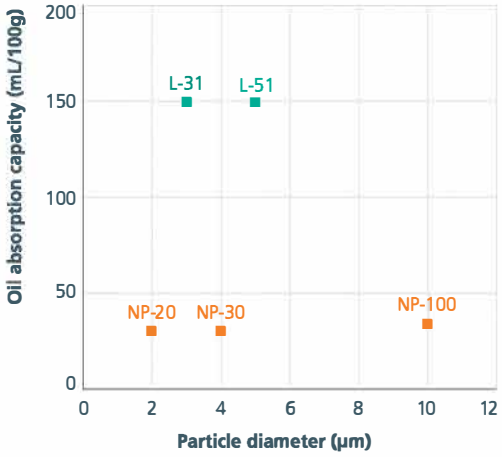
SOLESPHERE™ NP-30

Not all benefits can be obtained in all 3D printing technologies. Effects may vary and are formulation and process dependent.

Product Offering for 3D Printing Formulations

Silica Product	Particle Size (µm)	Specific Gravity (g/mL)	Bulk Density (g/mL)	Mechanical Reinforcement	Spacing
L-31	3	2.18	0.18	✓	✓
L-51	5	2.18	0.23	✓	✓
NP-20	2	2.18	0.45	✓	✓
NP-30	4	2.18	0.55	✓	✓
NP-100	10	2.18	0.75	✓	✓

Note: AGC offers other grades with higher oil absorption and higher surface areas. If these are of interest, please contact us for more information.



For more information on AGC's products for 3D printing / additive manufacturing, please visit **www.agcchem.com**

AGC

AGC Chemicals Americas, Inc.
55 E. Uwchlan Avenue, Suite 201
Exton, PA 19341
United States of America

Telephone: +1 610-423-4300
Toll Free (US only): 800-424-7833
Fax: +1 610-423-4305

www.agcchem.com
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