

## Direct Manufacturing with NanoForm™ 15120: Small Parts, Big Potential

German based RP service bureau VG Kunststofftechnik sees great potential in direct manufacturing via stereolithography (SL)—especially with the recent availability of high-performance composite SL resins like Somos NanoForm™ 15120.

Commercialized in November 2004, NanoForm 15120 is a composite stereolithography material which incorporates non-crystalline nanoparticle technology for enhanced performance properties, including exceptionally high stiffness and heat resistance. Heat deflection temperatures of more than 500°F (265°C) have been reported.

VG began direct manufacturing with NanoForm as soon as it was commercial, running the material on their 3D Systems Viper SL. Their initial focus was on small detailed parts for the electronics, aerospace and medical industries as well as for water-technology specialists such as Hansa and Grohe. Today, having since proven both the resins material properties and ‘break-even’ economics, VG regularly produces up to 200 directly manufactured NanoForm parts for pre-series and limited series production.

“NanoForm offers a unique set of properties which are critical for direct manufacturing,” says VG founder and Managing Director Dr. Völker Griessbach. “Its accuracy, zero hydroscopicity and exceptional surface quality—with practically no ‘stair stepping’ effects—deliver the high level of precision and detail which the electronics industry in particular requires, as well as guarantees the dimensional stability of the parts.”

“In addition, NanoForm has a completely water-resistant surface and can withstand temperatures as high as 250°C. That adds up to a number of critical advantages for our clients’ extensive pre-series testing.”

In addition to allowing VG to produce parts with a high degree of geometric-complexity (typical wall dimensions can run down to 0.3mm—beyond the limits of alternative RP technologies), direct manufacturing with NanoForm has also proven successful in avoiding some of the delays and costs related to the tooling process.

In one project, Siemens required 1000 electromagnetic coils for their summer and winter automotive tests. After just one week, VG Kunststofftechnik was able to deliver NanoForm parts which were immediately reeled-up, mounted, soldered, and plastic coated.

The test program was extremely successful, enabling Siemens to save approximately €40,000 in tooling costs and avoid a three month delay to the

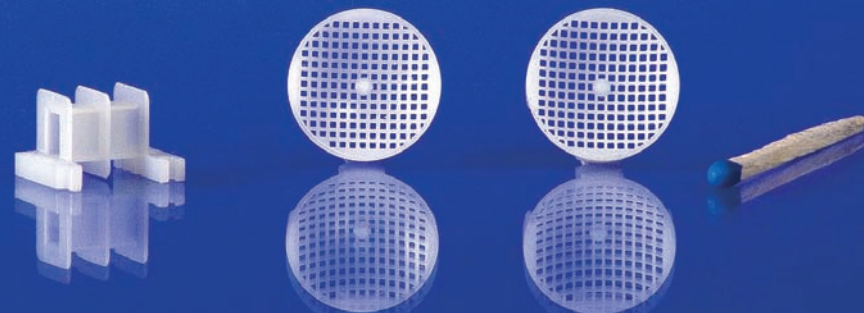
program—effectively allowing the tests to move forward four months ahead of schedule.

“I believe direct manufacturing will go down in history as the third industrial revolution,” says Griessbach. “It is an increasingly proven method for industry to shorten development cycles and meet the growing demand for low-run, custom tailored parts. For VG, combining the right technologies with effective new materials like NanoForm is helping us become a pioneer in direct manufacturing—just as we set out to be with rapid prototyping more than fifteen years ago.”

*For a list of service bureaus currently running NanoForm 15120, visit [www.dsmsomos.com](http://www.dsmsomos.com) today.*

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— Dr. Völker Griessbach,  
Founder & Managing Director, VG Kunststofftechnik



*VG Kunststofftechnik uses NanoForm™ to regularly produce up to 200 directly manufactured parts for pre-series and limited series production. Pictured above (from left): base part for an electromagnetic coil for Siemens and prototypes of water filters for Grohe.*

## Converting from HeCd to Solid State Laser: Need help optimizing the build?

Conversion from a HeCd laser to solid state laser in your stereolithography machine brings several advantages including longer laser life, the ability to run multiple machines with one laser, and use of some of the industry's newest resins (developed primarily for solid-state systems).

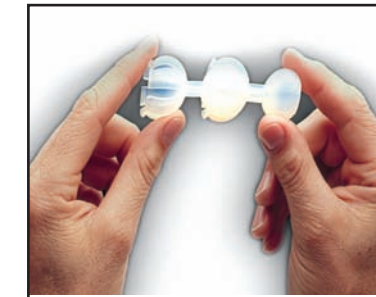
With help from National RP Support ([www.rpsupport.com](http://www.rpsupport.com)), the conversion of a Helium Cadmium machine—such as the 3D Systems SLA-250—to a machine using a solid state laser can easily be done. But this conversion requires more than just a change of laser. Your HeCd-compatible Somos resins must also be replaced with their solid state counterparts (Somos product numbers ending in “110” denote HeCd suitable resins, while those ending in “120” denote solid state suitable resins.)

“Replacing the resin is a fairly simple process,” says Somos Technical Service Specialist John Schaefer, “but the build

parameters will need to be optimized for the new resin and laser, requiring build styles that are modified from what the operator is used to.”

If you are in need of new build styles, they may be easily requested online from the DSM Somos website ([www.dsmsomos.com](http://www.dsmsomos.com), click on “Products,” then “Request Materials”). Once you have submitted your style file request, a Somos representative will send you the files or contact you for more information.

DSM Somos has installed several dual systems onsite at their new facility in Elgin, Illinois, where two of 3D Systems’ SLA-250 machines run off of one laser beam. These machines and their operation will be on display during the SME tour, offered in conjunction with the Rapid Prototyping and Manufacturing show, on Monday, May 22, 2006. For more information about the tour, visit [www.sme.org/rapid](http://www.sme.org/rapid).



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Editor

*The Part We Play* is published by DSM Somos as an information resource for the rapid prototyping industry. Reader inquiries and suggestions for content are welcomed and should be directed to:

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# The Part We Play

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## DSM Somos: A long history of driving the market forward...

Growing the stereolithography market through technology development is a cornerstone of DSM Somos' business strategy. Our reputation as a leading materials technology innovator has been built both upon market firsts—such as WaterClear™ and WaterShed® ABS-like materials and ProtoTool 20L™ and NanoForm™ 15120 composite SL resins—as well as products tailored for “best in class performance” in applications such as investment casting, ultra precise patterning and rapid tooling.

As we move toward the future in the SL materials market, Somos' technology path will focus on two important activities: building on the foundations

of today's versatile multi-purpose resins, and pressing “outside the box” with new technology platforms to create highly unique, specialty performance materials.

**Evolution of the Multi-Purpose “Workhorse” Resin**  
The multi-purpose SL resin continues to be the true “workhorse” of today's SL industry. Broadly utilized in applications varying from concept modeling to fit and function testing and patterning, these materials are successfully able to mimic key performance characteristics of various production plastics.

Multi-purpose materials have evolved significantly over the past decade (see box on page 2), though typically still remain limited to prototyping applications or very specialized rapid manufacturing applications.

**ABS-Like Multi-Purpose Materials**  
Today, ABS-like multi-purpose resins are the most widely used class of SL products. Beyond the general requirements of strength, stiffness and toughness, further differentiation within this class of materials has been created in process robustness and speed, dimensional consistency,

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Direct Manufacturing with  
NanoForm™ 15120

### INSIDE

Converting from a HeCd  
to Solid State Laser:  
Optimizing your Build

New Business  
Opportunities  
with ULM™ 17220



Unlimited. **DSM**

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## Driving the Market

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aesthetics and specialized physical performance parameters.

### Evolution of the Multi-purpose SL Resin

**Mid-to late 1990s** – epoxy-based, rigid, strong, lower-elongation materials (such as the Somos 7100 series)

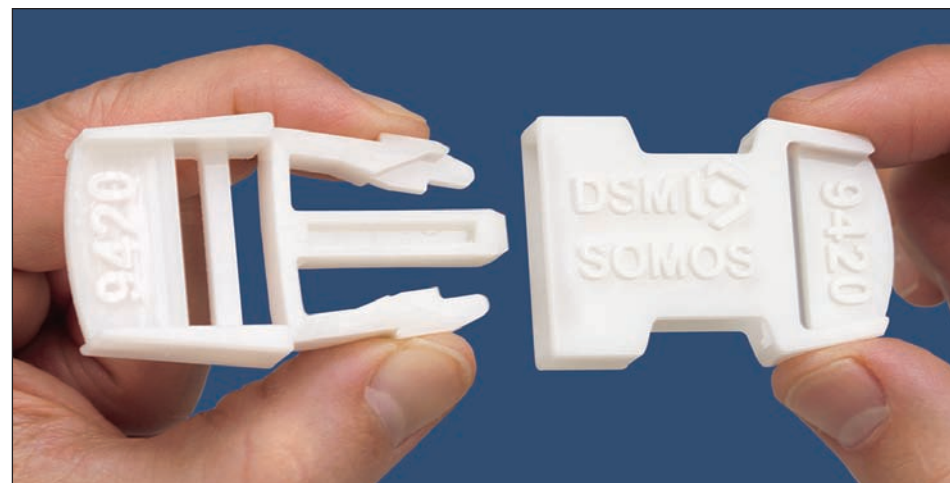
**2000** – high elongation/low-to-midrange modulus materials that perform like polyethylene and polypropylene (Somos 8100 and 9100 series resins)

**Early 2000s** – mid-level elongation, high modulus ABS “perform-a-like” materials (Somos 10120, 11120 series resins).

Somos WaterShed® 11120, today’s most widely used ABS-like resin, features build speeds up to 30% faster than competitive systems, high clarity, and low viscosity that facilitates faster builds, part clean up, and very low water absorption characteristics. These differentiation enhancements have made WaterShed 11120 a preferred resin particularly for investment casting applications.

#### Aesthetics plus Performance

Even within established material families such as the polypropylene and ABS-like



**Performance & Aesthetics:** “Our customers really like the flexibility and brightness of the parts being made with the new Somos 9420 resin, as well as the excellent detail it shows off,” says Jennifer Shaffner, Prototype Manager of GTC Specialties (one of three service bureaus currently beta testing the material). “This material promises to be a best seller— particularly for snap-fit assemblies and other applications that require part flexibility.”

multi-purpose resins, further differentiation has been achieved. Transparent resins, such as Somos WaterClear™ 10120 and WaterShed® 11120, have enabled new levels of fluid flow analysis as well as transparent fit and function visual inspections.

Part aesthetics that resemble typical injection molded plastics have also now gained preference in unpainted applications. For these white materials, Somos 14120 White and the new Somos 9420 EP-White feature the brightest white aesthetic currently available from

ABS and polypropylene-like SL materials. Most importantly, these resins have been successfully formulated to not compromise processing speeds—an increasingly important differentiator for both OEMs and service bureaus when using pigmented materials.

#### Niche Resins

Multi-purpose SL materials typically fall within the stiffness-toughness range of 1000 to 3000 MPa and 4-30% elongation. Within this range, DSM Somos has been the most prolific developer of niche resins—unique products that meet specialized needs.

With an HDT of ~130°C after thermal post-cure, Somos ProtoTherm™ 12120 was developed for highly elevated temperature performance, while at the same time meeting the need for accuracy and very low water absorption. A gray version of ProtoTherm, Somos 12920 Precision HT™ was later introduced in 2005 and, that same year, Somos FR 16120 became the industry’s first SL resin with demonstrated UL 94V-O capability.

### Out of the Box Performance: Moving Beyond the Multi-Purpose Resin

While important advancements continue to be made within the realm of today’s multi-purpose SL materials, Somos has also committed itself to the development of specialty high-performance SL resins that perform “outside the box” of the traditional range of performance properties.

#### Composite Resins

In 2003, the first reinforced SL resin—a significant advance in SL formulation technology—was premiered. With an exceptionally high modulus and heat deflection temperature, Somos ProtoTool™ 20L performed far outside the parameters of typical multi-purpose resins, producing parts suitable for wind testing models as well as rekindling interest in SL for rapid tooling applications. Its elevated level of performance also made ProtoTool useful for several

new, high-performance application areas, such as Formula 1.

NanoForm™ 15120 soon followed the introduction of ProtoTool, as the first composite material fully reinforced using nano-particle technology. While NanoForm resembled multi-purpose materials with regard to its typical SL processing, the resin offered low shrink characteristics well below traditional neat SL resins, creating opportunities in highly precise pattern applications.

#### Specialty Niche Resins

DSM Somos continues to invest in physical performance characterization that moves beyond the typical resin properties of modulus, strength and impact resistance. Recently, Somos has “stretched” well outside the conventional property range of multipurpose resins with the introduction of Somos ULM™ 17220 ( Ultra Low Modulus )—a highly elastomeric material featuring up to 100+% elongation.

ULM pioneers a growing class of specialty niche materials developed by DSM Somos as part of a strategic emphasis on growing the SL market through new application opportunities.

“Success in exploring specialty niches requires the identification of a clear OEM performance requirement, followed by a good fit between product and process

capability,” says Somos Marketing Manager Eva Montgomery. Use of these materials is then carefully supported through technical service—as they typically function outside the “pour and play” robustness of multipurpose resins—and promoted through the joint marketing efforts of the SL resin supplier and user for maximum market penetration.

### Driving the Market Toward the Future

Through ongoing advancements in today’s most versatile multipurpose SL resins, as well as the innovative development of high-performance specialty materials, Somos continues to drive the SL materials market toward the future. Ultimately, we believe that future will involve the mainstream application of stereolithography for mass customization and low volume end-use production.

In the coming months, watch for new Somos products that further fortify technology leadership positions in multipurpose and composite materials, as well as a major new (yet market proven) chemistry platform.

Who would have thought that Shakespeare’s words would be equally relevant to our efforts when he wrote, “The past is but prologue...”



When Paris-based engineering and rapid prototyping group *Groupe Erpro* began beta-testing Somos ULM 17220 last year, they found it produced detailed, rubber-like parts that “exceeded” even their initial expectations.

Since ULM’s commercialization in September 2005, Erpro has enjoyed a diverse new spectrum of prototyping opportunities thanks to the innovative resin—most notably from automotive OEMs and component suppliers.

“For the first time, the rapid prototyping industry has a rubber-like material which combines excellent mechanical properties, surface quality and detail with a resistance to both temperature and hydrocarbons,” says Groupe Erpro’s Managing Director Cyrille Vue.

“ULM has allowed us to overcome some of the deficiencies inherent to other elastomeric-like RP materials—such as in accuracy and surface quality. Perhaps more importantly, we’ve also cut out the time and cost involved with vacuum casting parts, which used to be our standard method for producing elastomeric-prototypes.”

Erpo, whose client base includes Renault, Visteon, Faurecia, Delphi,

### Service bureaus currently running ULM 17220:

[U.S. Accelerated Technologies Inc. Express Pattern](#)

[Europe Alphaform AG](#)  
[Groupe Erpro](#)  
[Materialise](#)

without compromising key performance properties such as flexibility and tear-strength,” says Vue.

“Add to that the fact that ULM is also water resistant—unlike elastomeric-like selective laser sintering (SLS) materials. We’ve really have been able to open up a whole new range of prototyping opportunities.”

For more information about Somos ULM 17220, contact your account representative today, or log on to [www.dsmsomos.com](http://www.dsmsomos.com).

**Somos ULM™ 17220**  
(Ultra Low Modulus material)

- Shore A Hardness.... 70
- Elongation @ break... 75-100+%
- Tear Strength (Graves)... 406.3 N/m
- Dielectric Strength... 13.6 kV/mm

## DSM Somos Product Development Highlights: 2000-Present



WaterClear™ 10120

2000



WaterShed® 11120

2001



ProtoTool™ 20L

2002



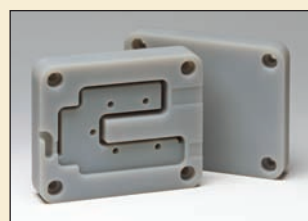
ProtoTherm™ 12120

2002



14120 White

2003



NanoForm™ 15120

2004



ULM™ 17220

2005



9420 EP-White



FR 16120



Precision HT™ 12920