Published 11/1/2008

Colloidal Silica Processing Aid Slashes Molding Cycle Times

Ultra-fine synthetic silica particles have been shown in laboratory and commercial field trials to reduce injection molding cycle times by 20% to 30% in polypropylene, filled and unfilled nylon, PBT, and ABS.

ADDITIVES · TESTING · COMPOUNDING · MULTISCREW

LILLI MANOLIS SHERMAN
Contributing Editor, *Plastics Technology Magazine*

Share

Read Next

SUSTAINABILITY Lead the Conversation, Change the Conversation

NPE Beyond Prototypes: 8 Ways the Plastics Industry Is Using 3D Printing

Ultra-fine synthetic silica particles have been shown in laboratory and commercial field trials to reduce injection molding cycle times by 20% to 30% in polypropylene, filled and unfilled nylon, PBT, and ABS. This processing advantage is accompanied by retention and even improvement of key physical properties. Other reported benefits are improved color dispersion
and reduced flow lines and surface defects. What's more, the silica additive is said to mix easily with resin pellets in a blender, so melt pre-compounding is not required.

Nan-O-Sil ASD additive is high-purity, amorphous, colloidal silica in the form of a white powder. The spherical particles range in size from 0.02 to 0.55 microns (20 to 550 nanometers). Nan-O-Sil ASD is manufactured and marketed by Energy Strategy Associates, Inc., which has been working with technical consulting and R&D firm Rheo-Plast Associates to develop applications for this additive. Headed by Dr. Pravin L. Shah, Rheo-Plast specializes in polymer rheology and its application to extrusion, injection molding, and compounding of engineering plastics and blends/alloys. Rheo-Plast conducted laboratory testing of Nan-O-Sil in a variety of resins. Dr. Shah supplied the test results to Plastics Technology for this article.

Featured Content

Sponsored — Five Ways to Increase Productivity for Injection Molders — READ MORE
A Simpler Way to Calculate Shot Size vs. Barrel Capacity — READ MORE
Sponsored — iNOEX Celebrates Forty Years of Intelligent Measurement and Control Solutions at NPE2024 — READ MORE

EXPERIMENTAL RESULTS

Injection molded sample bars were obtained by first tumbling resin pellets with Nan-O-Sil ASD for 15 min in a Conair blender. The additive coated the pellets well and uniformly, Shah reports.

Table 1—Faster Injection Molding Cycles With Nan-O-Sil ASD

Material w/ 0.8% Nan-O-Sil	Avg. Cycle Time Reduction
PP, unfilled	22%
Nylon 6, unfilled	24%
Nylon 66, 33% glass	32%
PBT, unfilled	26%
ABS, unfilled	25%

The most dramatic results with Nan-O-Sil ASD are the cycle-time reductions for PP, unfilled nylon 6, glass-filled nylon 66, unfilled PBT, and ABS (see Table 1). The additive also shows utility as a reinforcing filler that can raise the stiffness of PP and both stiffness and strength of nylon 6 and PBT (Tables 2 to 5). Depending on the resin and the amount of Nan-O-Sil used, there was little or no sacrifice of other properties, such as elongation or toughness.

In glass-filled nylons, using larger amounts of Nan-O-Sil ASD appears to have potential for reducing the amount of glass fiber required to improve strength and stiffness. One trial compared the physical properties of 13% glass or 10% Nan-O-Sil in nylon 6. As shown in Table 4, colloidal silica imparted a greater increase in tensile strength and flexural modulus than did the glass fiber. According to Shah, an in-depth study of combinations of Nan-O-Sil ASD and glass fiber is under way and results will be published next year.

HOW IT WORKS

Although the precise mechanism by which Nan-O-Sil ASD reduces cycle times and improves strength properties of molded plastics is still unclear, Shah says the additive has been shown to work at low addition levels of 0.4% to 0.8% as a heat sink to reduce the amount of cooling required during molding. Based on Brabender torque rheometer data, he also postulates that the additive works as a processing aid to reduce the shear gradient at the gate and facilitate melt flow orientation.

Also not clearly understood at present is the apparent melting-point depression observed in PP, though no such effect was evident in nylon. Further work is under way to determine the additive's behavior in melt processing.

Table 2—Nan-O-Sil ASD in Polypropylene

Material	Tensile Str. @ Yield, psi	Elongation @ Yield, %	Tensile Mod., psi	Gardner Impact, in.-lb/in.	Flexural Modulus, psi	Flex. Str., psi	MFI, g/10 min	Melt Point, C
PP Control	3000	9.7	145,000	2.18	112,000	3350	8	168
PP/0.4% Nan-O-Sil	3020	8.9	151,000	2.15	122,000	3570	8.2	163
PP/0.8% Nan-O-Sil	2930	8.2	144,000	2.12	118,000	3520	8.3	160

TABLE 3—Nan-O-Sil ASD in Nylon 6

Material	Tens. Str. @ Yield, psi	Elongation @ Yield, %	Tensile Mod., psi	Gardner Impact, in.-lb/in.	Flexural Modulus, psi	Flexural Strength, psi	HDT @ 66 psi, F
Nylon 6 Control	8710	4.5	315,000	2.18	224,000	9300	140
Nylon 6 + 0.4% Nan-O-Sil	8760	4.5	320,000	2.18	227,000	9330	140
Nylon 6 + 0.8% Nan-O-Sil	9020	4.6	320,000	2.15	237,000	9840	140

TABLE 4—Nan-O-Sil ASD Vs. Glass Fiber in Nylon 6

Material	Tensile Str. @ Yield, psi	Elongation @ Yield, %	Tensile Mod., psi	Gardner Impact, in.-lb/in.	Flexural Modulus, psi	Flexural Strength, psi	HDT @ 66 psi, F
Nylon 6 Control	8710	4.5	315,000	2.18	224,000	9300	140
Nylon 6 + 13% Glass	8760	4.5	320,000	2.18	227,000	9330	140
Nylon 6 + 10% Nan-O-Sil	9020	4.6	320,000	2.15	237,000	9840	140

Table 5—Nan-O-Sil ASD in PBT

Material	Tensile Str. @ Yield, psi	Elongation @ Yield, %	Tensile Modulus, psi	Gardner Impact, in.-lb/in.	Flexural Modulus, psi	Flex. Str., psi	MFI, g/10 min
PBT Control	7400	3.6	145,000	2.18	355,000	3350	8
PBT+ 0.4% Nan-O-Sil	7400	3.4	151,000	2.14	374,000	3570	8.2
PBT+ 0.8% Nan-O-Sil	7600	3.2	144,000	2.1	380,000	3520	8.1

Related Content

7 NOV 2022
Comprehensive Optical Inspection for PET Preforms
Delta Engineering teams with Intravis to inspect preform mouth, body, thread and color.
READ MORE

K SHOW 9 NOV 2022
Handheld NIR Instrument Distinguishes PET from PETG
Mobile spectroscopy from trinamiX detects more than 30 different plastics—and now PET vs. PETG as an aid to recycling.
READ MORE

PACKAGING 21 OCT 2022
Dual-Mode Portable Thickness Gauge for Packaging
Hand-held "pen" measures sheets, containers, panels, large parts with magnetic or capacitance mode; controlled by Bluetooth phone app.
READ MORE

POSTPROCESSING 5 APR 2023
X-Ray Vision Inside Parts Gets More Affordable for Processors
Shimadzu's new benchtop x-ray CT scanner provides internal and external metrology and flaw detection at a fraction of the previous cost.
READ MORE

Published 4/29/2024

Safety, Recycling, and Compounding Trends Bring New Opportunity to 70-Year-Old Company

NPE2024: Vac-U-Max presents pneumatic conveying solutions for powdered materials.

RESIN CONVEYING · FEEDING & BLENDING · COMPOUNDING · NPE

Matt Stonecash
Associate Editor, *Plastics Technology Magazine*

Share

Read Next

NPE Making the Circular Economy a Reality

SUSTAINABILITY Lead the Conversation, Change the Conversation

"We've been loving powders for 70 years," says David Kennedy, business development manager at Vac-U-Max. The company began in 1954 with a single product, its industrial vacuum cleaner powered with compresssed air. By removing the electrical power supply as a potential source of ignition, the cleaner provides a safe way to clean up dusts, most of which are combustible in some conditions.

The descendants of that original product are still part of the company's portfolio, along with vacuum systems for material conveying, which usually function to deliver powders from the ingredient supply to a twin-screw extruder, either directly or through a feeder system.

Featured Content

Sponsored — iNOEX Celebrates Forty Years of Intelligent Measurement and Control Solutions at NPE2024 — READ MORE
Sponsored — Reduce Downtime and Scrap in the Blown Film Industry — READ MORE
A Simpler Way to Calculate Shot Size vs. Barrel Capacity — READ MORE

Vac-U-Max Signature Series conveying systems. Source: Vac-U-Max

The historical trends that impact powder conveying have only accelerated in recent years. The rise of ever more specialized materials have necessitated greater accuracy. "Compounding has become more sophisticated," Kennedy says. "There are new kinds of functional recipes for fire resistance, for health care, for biodegradable and new hybrid products mixing plastics with other materials. There is much more need for accuracy and quality control."

At NPE2024, Vac-U-Max will also seek to connect with businesses that are using recycled material in their products, a change from past shows where the focus would have been squarely on users of powdered ingredients.

The irregular shape and properties of recycled plastic flakes present their own challenges, and these materials are often being mixed with wood flour, fiberglass or abrasives to make composite materials. Vac-U-Max considers non-free-flowing materials such as recycled plastic waste to be its specialty. "Recycled plastics are the epitome of non-free-flowing," Kennedy says.

As health information and labor agency have raised the bar for worker safety, minimizing exposure has become a priority for facilities. Loose dust from manual dumping and refilling can be both an inhalation and combustible hazard, and vacuum conveying can serve to minimize those issues. "Dust can build up on rafters, on top of machinery — and some of the ingredients in compounding can be an immediate health hazard," Kennedy explains. "When you move things by vacuum conveying, even if you do have a leak, it is less of a problem." This is because the pressure differential tends to pull dust toward the equipment rather than disperse it out into the surrounding area.

Vac-U-Max conveying systems for powders and granules can work with scales from the handful size up to 25,000 lbs/hr.

NPE2024 The Plastics Show

NPE 2024

VAC-U-MAX will be exhibiting new technology at NPE 2024 in Orlando, FL this May.

Plan to meet up with their team or get registered here!

Related Content

Cut Loading Time Through Direct Charge Blending
Direct charge blender loading, a vacuum-powered automation process, can dramatically improve loading time and reduce material costs. In this article, we address ten common questions to help you determine if the...

Automated Resin Management and Blending System for Tight Spaces
NPE2024: Designed for new and existing operations with up to 10 machines and limited available space.

'Digitalization' – Awkward Term for a Vital Concept
At K 2022, 85 machines from 40 companies showed off their Industry 4.0 capabilities via OPC-UA interface. A new universal interface for Material Supply Systems was revealed at the show.