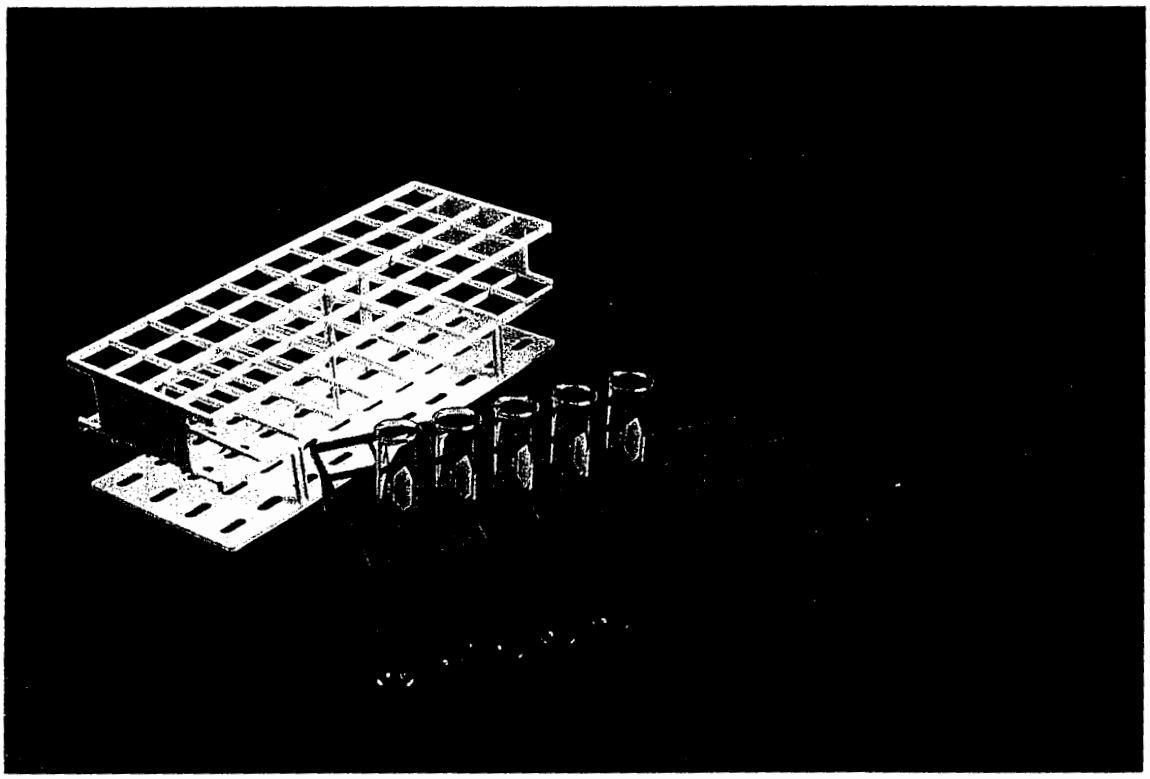
Shell Chemicals

CARILON POLYMERS CASE HISTORY

Nalge Nunc International



A 15% glass-filled grade of CARILON™ Polymers was used as a successful replacement for glass-filled acetal homopolymers in the manufacturing of Nalge Nunc International test tube racks. NNI, one of the largest suppliers of research lab equipment, required the material to be autoclavable (a high heat sterilization process), without the formaldehyde fumes found in acetal. CARILON Polymers' strength, impact resistance, hydrolytic stability and receptiveness to general purpose colorants convinced NNI that they had found the right material. For more information about CARILON Polymers, call 1-888-CARILON (888-227-4566).

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PRESS INFORMATION

CARILON Polymers from Shell Chemicals Solve Emission Problem for Lab Products Manufacturer

Nalge Nunc International Case History

Faced with growing customer complaints of formaldehyde emission from its Unwire™ Test Tube racks during high heat sterilization, Nalge Nunc International (NNI), one of the world's largest research lab suppliers, sought a new injection molding material to replace polyacetal.

"Fumes from the original material used to make the test tube racks had become a problem for some of our customers, especially those autoclaving multiple racks," says Sharad Rajguru, senior plastics engineer at NNI. "We had to find a solution."

The original material, a glass-filled polyacetal homopolymer, had been used since the early 1980s. However, when exposed to high heat, the polymer's fumes were reported by lab workers to cause watery eyes and sinus irritation. "We had been looking for an alternative material for many years," Rajguru explains, "and approximately one hundred materials were evaluated before the project was assigned to me. Because of our stringent requirements, no material had yet been identified to replace acetal."

Enter CARILON[1] Polymers from Shell Chemicals[2]. Rajguru was charged with the task of identifying a suitable substitute material in late 1996, just as CARILON Polymers were introduced to the U.S. market. He was tipped off to CARILON Polymers' desirable qualities by an NNI executive who had seen the new product at a trade show.

"Sharad called us and explained the situation, and we decided to put CARILON Polymers to the test," says Bob Pilotti, CARILON Polymers' market development manager who works with NNI. "We knew we had the temperature resistance and impact strength required, and since CARILON Polymers is made with carbon monoxide and alpha olefins there should not be the emission problem experienced with acetal."

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[1]CARILON is a Shell trademark.

[2] The expression 'Shell Chemicals' refers to the companies of the Royal Dutch/Shell Group which are engaged in the chemicals business. Each of the companies which make up the Royal Dutch/Shell Group of companies is an independent entity and has its own separate identity.

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In mid-1997, NNI formally began evaluation of CARILON Polymers as the possible substitute. Specifically, NNI wanted to gauge its ability to meet four different requirements:

- The material had to be autoclavable, that is, able to tolerate the medical sterilization process commonly done in an autoclave device by exposing it to extreme heat and moisture;
- The material had to be heavier than water and not warp or deform in immersion tests;
- The material had to be colorable to meet medical lab color-coding requirements; and
- The material had to be able to withstand NNI's impact tests.

"NNI's test tube rack consists of many knit lines where the intricate material flow paths come together, which made the impact test requirement a technical challenge for other materials," explains John Kelley, CARILON Polymers' research engineer. "CARILON Polymers have a unique balance of high impact strength and flexural modulus, allowing the material to absorb impact – even for these parts with potential knit-line problems."

In addition, CARILON Polymers' resistance to hydrolysis was a defining factor in its ability to maintain its performance properties during the immersion tests.

CARILON Polymers are easy to process on most conventional injection molding equipment. Tests confirmed that CARILON Polymers not only worked with NNI's existing production equipment, but offered several key benefits:

- CARILON Polymers have lower specific gravity than polyacetal, decreasing material requirements;
- Using CARILON Polymers reduced production set-up time, and a change in the injection molding pressure enabled NNI to manufacture the racks faster, resulting in increased capacity and decreased production cost;
- CARILON Polymers do not emit odors when processing, eliminating the need for expensive exhaust systems; and
- CARILON Polymers are receptive to general purpose colorants. The previous compound required more expensive custom coloring.

Although CARILON Polymers' unfilled grade met all the production requirements, including strength and impact resistance, NNI decided to use the 15 percent glass-filled grade. The additional rigidity in the PK compound gave the test tube rack the same "feel" as the glass-filled acetal rack customers were used to. Presented with an easily adaptable alternative to polyacetal,

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NNI began production of the test tubes racks made from CARILON Polymers in October 1997.

"Because of CARILON Polymers combination of benefits, the finished part actually cost less than the polyacetal version, and now NNI is considering using CARILON Polymers for several other lab products," says Michelle Londa, CARILON Polymers' marketing manager - Americas.

CARILON Polymers are engineering thermoplastics with a unique combination of physical properties compared to traditional materials such as polyamides and polyacetals. These properties include strength, stiffness, performance over a broad temperature range, toughness, superior wear and friction characteristics, low hydrocarbon permeability and resistance to a variety of aggressive chemicals.

CARILON Polymers are available in extrusion grades and a variety of injection molding grades, including glass reinforced, flame retardant, mineral filled and lubricated compounds. The polymers can be easily processed on conventional molding and extrusion equipment, and their fast set-up can lead to significantly reduced cycle times in injection molding applications.

For more information on CARILON Polymers, visit the Shell Chemicals Web site at *www.shellchemicals.com*. In the United States, customers can write to Shell Chemical Company, P.O. Box 2463, Houston, Texas 77252-2463 or call toll free at 1-888-CARILON (1-888-227-4566). In Europe, customers can write to Shell Chemicals Ltd., Shell Centre, SEI 7NA or call +44 171 934 3300.

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Polyketone tests best for test tube racks

Rochester, NY—When you make racks for test tubes, the last thing you want to hear is customers complaining about formaldehyde escaping from the racks during high-heat sterilization. However, that's exactly what happened to Nalge Nunc Int'l (NNI), one of the world's largest research lab suppliers.

"Fumes from the original materials used to make the test tube racks had become a problem for some of our customers, especially those autoclaving multiple racks," says Sharad Rajguru, senior plastics engineer at NNI. "We had to find a solution."

NNI found that solution in Carilon® polymers, a family of aliphatic polyketones from Shell Chemicals (Houston). The original material, a glass-filled acetal homopolymer, had been used since the early 1980s. When exposed to high heat, the polymer's fumes were reported by lab workers to cause watery eyes and sinus irritation. "We had looked for an alternative material for many years," Rajguru explains. "In fact, we had already evaluated about 100 materials when the project was assigned to me. Because of our stringent requirements, no material had yet been identified to replace acetal."

Rajguru was tipped off to Carilon polymers' desirable qualities by a sales representative from LNP Engineering Plastics (Exton, PA), a provider for NNI's glass compounding. About the same time, an NNI executive had seen the materials profiled at a trade show.

"Rajguru called us and explained the situation, and we decided to put our polymers to the test," says Bob Pilotti, Carilon polymers' market development manager. "We knew we had the temperature resistance and impact strength required, and since our materials are made with carbon monoxide and alpha olefins, there should not be the emission problem experienced with acetal."

NNI formally began evaluating Carilon polymers in mid 1997. The material NNI desired had to:

- Tolerate the medical sterilization processes commonly done in an autoclave device.
- Be heavier than water and not warp or deform in immersion tests.
- Be colorable in order to meet medical lab color-coding needs.
- Withstand NNI's impact test requirements.

NNI's test tube rack consists of many knit lines where the intricate material flow paths come together, which made the impact test a technical challenge for other materials," explains John Kelley, Carilon polymers' research engineer. "Our materials have a unique balance of high impact strength and flexural modulus, allowing them to absorb impact—even for parts with potential knit-line problems."

In addition, the resins resist hydrolysis, a defining factor in their ability to maintain performance during immersion tests. And they process easily on most conventional injection-molding equipment.

Not only did the NNI tests confirm that Carilon polymers worked with the company's existing production equipment, but the material offered several key benefits:

- A lower specific gravity than acetal, decreasing material requirements.
- Reduced production set-up time, coupled with a change in the injection-molding pressure, that resulted in increased capacity and decreased production costs.
- Lack of odors when processing, which eliminated the need for expensive exhaust systems.
- Ability to accept general-purpose colorants instead of more expensive custom coloring agents.

Actually, Carilon polymers' unfilled grade met all the production requirements, including strength and impact resistance. However, NNI decided to use a 15% glass-filled grade. The added rigidity in the compound gave the test tube racks the same "feel" as the former glass-filled acetal racks.

NNI began production of the test tube racks last fall. "Because of Carilon polymers' combination of benefits, the finished part actually cost less than the acetal version," notes Michelle Londa, Carilon polymers' marketing manager-Americas. As a result, NNI is considering the use of the material for several other lab products. dn

For more information on Carilon polymers from Shell Chemical (M): **Circle . . .538**

Test tube racks made from an aliphatic polyketone survive repeated attacks from sterilization.

POLYKETONE KEYS TEST TUBE RACK DESIGN

	CARILON POLYMERS ALIPHATIC POLYKETYONE	*DUPONT DELRIN ACETAL*
GRADE	DPR1115-1000	570
% GLASS FIBER BY WEIGHT	15	20
MELT POINT (DEG F)	428	347
SPECIFIC GRAVITY	1.34	1.56
TENSILE STRENGTH (PSI)	12,500	8,500
ELONGATION @ BREAK	6.0	12.0
FLEXURAL MODULUS (PSI)	550,000	730,000
NOTCHED IZOD IMPACT @ –40F (FT-LB/INCH)	1.2	0.5
DEFLECTION TEMP @ 264 PSI (DEG F)	425	316

Source: Shell Chemicals

Based on tough evaluations by Nalge Nunc International, an aliphatic polyketone outperformed acetal in this test tube rack application.