2007/1

DuPont Engineering Design

The Review of DuPont Engineering Polymers in Action

DUPONT®

The miracles of science™

InCon: A broad-based strength

An Interview with John M. Fisher, marketing Manager, Industrial, Consumer and Electrical/Electronic markets — Engineering Polymers

One of the strengths of DuPont's Engineering Polymers business is the broad range of industries and array of applications in which its products are used worldwide. "New automotive applications usually get 'star billing', while successes in other industries play a humbler role. This creates the false impression that automotive applications represent most of our revenue," says John Fisher, marketing manager, Industrial, Consumer (abbreviated as InCon) and Electrical/Electronic markets. "Automotive is, and will remain, the most important single industry for our engineering polymer products," he concedes. "But we believe in spreading our risks to maximize our long-term business returns.

"DuPont engineering polymers have been successfully used for decades in electrical and electronics, materials handling, domestic appliances and sports equipment. We are continuing to penetrate these markets with new applications. This issue of Engineering Design takes InCon as its theme, showing readers a few from the broad array of applications where EP products are used," Fisher declares.

"We are also investing a lot of development and marketing effort to open up fresh, high-growth applications in industries which are new to us such as healthcare, food-processing and the oil and gas industry. In many cases, success in these new areas is the fruit of recently developed technologies."

DuPont Engineering Polymers recently launched a program aimed at the healthcare industry, Fisher says, to support manufacturers of non-implantable medical apparatus, such as drug-delivery devices, diagnostics and surgical/hospital equipment. "We offer special resin grades, backed by specialist help in material selection, tool design, molding optimization and documentation of compliance with regulatory requirements."

DuPont™ Delrin® acetal resin has long been used for conveyor segments in many industries. Its combination of strength, stiffness, hardness, dimensional stability, toughness, resistance to fatigue, solvents and abrasion, low wear and low friction is hard to beat. Food conveyors, however, must meet an additional requirement: they must be made of materials that are detectable by metal-detectors. To overcome this hurdle, DuPont recently developed Delrin® 400MTD, which contains a proprietary filler detectable by industry-standard metal-detection equipment. "This new grade enables us to broaden our business with the food-processing industry, which is keen to profit from the advantages of plastic conveyors: they need less lubrication and consume less energy, make less noise and last longer, thanks to their low-wear qualities," says Fisher.

Another up-and-coming use for DuPont engineering polymers is also in food processing. DuPont™ Zytel® HTN high-performance polyamide and Zenite® LCP liquid-crystal polymer with their outstanding heat resistance, dimensional stability and regulatory compliance, are gaining acceptance as alternatives to metal for bakeware in the baking industry. Baking forms of these materials have consistent release performance over time, so there is no need to coat or grease tins; bakers save energy costs through shorter heating times and/or lower temperatures; polymeric bakeware cannot corrode; and lighter bakeware means easier handling. "The baking industry in Europe now uses some seven million metal baking tins." Fisher points out. "Replacing a percentage of these represents a considerable market opportunity."

DuPont Engineering Polymers has developed a range of special resins for the oil and gas industry. They include Pipelon® 401, for use as an extruded weartape layer in composite pipe systems. Pipelon® HT is a higher-performance resin for more demanding applications, including offshore umbilicals and other high-temperature oil pipes. Pipelon® PLR is designed to be a masterbatch additive to polyolefins, to reduce hydrocarbon permeation in oil and gas pipes. Independent trials have shown that the addition of only 10 percent of this high-performance resin reduces methane permeation by a factor of more than six. Pipelon® PLR opens a way to make pipe that meets increasingly stringent permeation requirements, yet without moving to a costly multilayer system.

"Another innovation from DuPont Engineering Polymers that will be of benefit to our customers worldwide in all market segments including InCon and E/E is the Selective Plating process, developed at our laboratories in Geneva, Switzerland. Read all about DuPont Engineering Polymers Selective Plating on the next page."

DuPont Engineering Polymers announces new 'Selective Plating' process

DuPont Engineering Polymers has developed a new technology at its laboratories in Geneva, Switzerland, called 'Selective Plating'. By using the 2K molding process customers can determine very precisely, which area of the surface of an injection molded part they want to galvanize. DuPont market development manager (new markets), Engineering Polymers, Europe, Stewart Daykin, said: "DuPont Engineering Polymers Selective Plating will be perceived as a functionality breakthrough for design engineers worldwide in a range of industries from Industry and Consumer Goods (InCon) to Electric and Electronic (E/E), to healthcare, cosmetics, appliances, sporting goods - and automotive."

The technology involves using one resin that is platable after running through an etching process and another resin that withstands the same etching conditions and thus remains unplatable. For example, reinforced and unreinforced PA 6 and PA 66, such as DuPont™ Minlon® or DuPont™ Zytel®, could be used for the platable resin. The broad range of resins not affected by the etching process covers certain engineering polymers as well as ethylene copolymers and transparent polymers.

Cost-effective, environmentally-acceptable, improved design freedom

DuPont Engineering Polymers Selective Plating permits the selective plating of injection molded parts, combining functionality and aesthetics.

As not only standard sulfochromic but also chrome-free treatment can be used for etching, the process can be run in accordance with European Environmental legislation (RoHS) on chrome content. Because just one mold is needed for the 2K molding process, DuPont Engineering Polymers Selective Plating is cost effective. The new process also gives design engineers increased design flexibility and expanded possibilities for brand differentiation. Possible applications include soft touch control buttons with galvanized partitions for appliances, E/E applications, or automotive parts such as internal door handles with metallic-plated and functional polymer parts.

Tried and tested with a range of engineering polymer combinations

DuPont Engineering Polymers has made Selective Plating samples (see photo) working with specific pairs of polymers using different grades of (platable) PA6 or PA 66 such as DuPont™ Zytel® and Minlon®, and the following non-platable resins:

-Unreinforced PA 612, such as DuPont™ Zytel®, which gives a semi-transparent effect;

-Hydrogenated styrene block copolymers (TPEs), which give a soft-touch effect;

-PPA, reinforced and unreinforced, with and without a toughener, such as DuPont™ Zytel® HTN high performance polyamides;

-Ionomer-based resins such as DuPont™ Surlyn®, which give a transparent effect;

-POM-based resins such as DuPont™ Delrin® and the special Delrin® Decorating Solutions (DS) grades, which give excellent mechanical properties;

-Ethylene copolymers such as DuPont™ Elvaloy® AC, which give a soft-grip effect.

Available today

DuPont Engineering Polymers is ready to work with its customers on Selective Plating today!

CONTACT

Alexandra Fabbro
or
Claudio Pierdomenico
Tel: +41 22 717 5111
email: plastics@che.dupont.com

DuPont Engineering Polymers Selecting Plating samples:
1. Plated Minlon® and Zytel® HTN; 2. Plated Minlon® and TPE; 3. Plated Minlon® and PA 612; 4. Zytel® HTN and plated Minlon®; 5 A non-plated control sample using white TPE and Minlon®.

contents

New Turkish coffee machine: tradition meets high-tech materials

Many manufacturers of domestic appliances are waking up to the potential of engineering polymers as an ideal replacement for metal. A recent illustration of this is the adoption of a heat-resistant, food-approved grade of DuPont™ Zytel® HTN high-performance polyamide as used in a modern-day version of the traditional 'cezve', or Turkish coffee pot, made by Arçelik A.S. of Istanbul, Turkey.

By Hasan Camur, DuPont Engineering Polymers, Turkey

The award-winning 'Telve' (right), aimed at the commercial market, was launched by Arçelik in 2004 and has two aluminum boiling pots. The 'miniTelve', launched in the fall of 2006, is a smaller unit aimed at the private/domestic market and features a single boiling pot made principally of Zytel® HTN.

The multi-patented 'miniTelve' coffee machine is a modern-day alternative to making Turkish coffee that was launched during the fall of 2006 by the Istanbul-headquartered company Arçelik A.Ş, an internationally-recognized producer of household appliances and components. It features a container for heating water and ground coffee which is made from silver-painted DuPont™ Zytel® HTN high-performance polyamide as an alternative to aluminum or copper.

The polymer's ability to retain mechanical properties such as strength, stiffness and toughness when exposed to heat and moisture, as well as its dimensional stability and approval for use in food and drink applications, were key factors in its selection.

"Turkish coffee" is a specific way of preparing coffee which is common throughout the Middle East, North Africa, Balkan countries and particularly Turkey. Believed to have originated in Damascus and to have become widespread during the Ottoman Empire, it traditionally involves a narrow-topped, small copper boiling pot, called a 'cezve', filled with finely ground coffee and cold water, which was placed in the hot sands of the Mediterranean for heating.

Such a method has remained largely intact over the centuries – albeit with a kitchen stove replacing the Mediterranean sand – yet, as with most forms of food preparation, there is constant consumer demand for increased convenience. Improved consumer convenience was the reason why Arçelik launched its initial 'Telve' automated coffee machine – the first of its kind and holder of eight patents – in 2004.

Aimed at the commercial market, it featured two modern-day 'cezves', made of aluminum,

"Turkish coffee" is a specific way of preparing coffee which is common throughout the Middle East, North Africa, Balkan countries and particularly Turkey.

The award-winning 'Telve' (right), aimed at the commercial market, was launched by Arçelik in 2004 and has two aluminum boiling pots. The 'miniTelve', launched in the fall of 2006, is a smaller unit aimed at the private/domestic market and features a single boiling pot made principally of Zytel® HTN.

that would prepare the coffee whilst the user could turn his attention to other matters without the risk of the coffee boiling over. Its concept and design was a recipient of an IF Product Design Award at the International Forum Design show in Hanover, Germany in 1995.

At the start of 2005 Arçelik looked to produce a smaller, cost-effective unit – the 'miniTelve' for the private/domestic market, which would feature a single boiling pot. "The production of the aluminum-forged 'cezve' proved to be too costly for our purposes, so we broadened our search for polymer alternatives," comments Levent Reisoğlu, project leader for both the 'miniTelve' and the 'Telve'. A long-standing relationship with DuPont, resulting in the use of a number of the company's high-performance polymers as a replacement for metal in a range of Arçelik products over the last ten years led to the trial of a food-approved grade of Zytel® HTN on a prototype tool.

DuPont's high-performance polyamide was subsequently adopted for the injection-molded body of the boiling pot, fixed to an aluminum base by a ring, also made of Zytel® HTN, and sealed with a heat- and moisture-resistant rubber. A two-part PBT handle is mounted to the body of the pot with a screw. Indeed the production process for the new Zytel® HTN pot consisted of only ten stages, compared to the 17 stages required for the aluminum pot.

Painted (above) and unpainted Zytel® HTN

In its external dimensions, the new boiling pot made of Zytel® HTN is identical to its aluminum predecessor – they both are 90 mm (3.5 in) tall with a maximum diameter of 90 mm (3.5 in) – yet its capacity is larger (200 ml (6.8 fluid ounces) versus 130 ml (4.4 fluid ounces)), thus enabling the pot to be used for the preparation of three cups of coffee rather than two. This is largely due to the polymer's greater geometrical and production flexibility versus aluminum, enabling designers at Arçelik to make the most effective use of the inside volume of the pot. The new design carries seven patent applications, three of which are related to the polymer boiling pot.

"With the benefit of material selection, design and processing support provided by DuPont, as well as our own use of computer-aided engineering tools such as mold-flow and warpage analysis, we were able to produce a boiling pot made principally from Zytel® HTN. It withstands repeated exposure to the heating process used in the coffee machine, involving temperatures of up to 150 degrees C (300 degrees F) for one to three minutes during each cycle depending on the amount of coffee being made, as well as recurring exposure to the boiling water it contains. Moreover, the pot was more durable than aluminum to the repeated knocks of daily use, meaning it retains its form over time and continues to fit smoothly into the machine," explains Reisoğlu.

A silver-like finish was achieved by applying one coat of a food-approved, heat-resistant paint to the Zytel® HTN. DuPont also provided advice on paint selection.

This development has served to raise awareness within Arçelik for the potential of engineering polymers from DuPont: "The 'miniTelve' is a high-profile project at Arçelik, and many of our engineers have been made aware of the heat-resistant performance of Zytel® HTN thanks to the success of our latest model," concludes Reisoğlu.

CONTACT

Levent H. Reisoğlu
R & D Department
Arçelik A.Ş.
Casamir Makinasi Isletmesi
34950, Tuzla, Istanbul
Turkey
Tel: +90 216 585 8431
Fax: +90 216 423 3045
e-mail: levent.reisoglu@arcelik.com
www.arcelik.com

Zytel® helps rejuvenate hardworking chisel

Baltimore Toolworks – a leading U.S. manufacturer of hand-made, precision-struck tools – taps DuPont™ Zytel® nylon to 'carve a new face' in chisel technology for its Hard Cap Safety Chisel line.

By Rick Tobar, DuPont Engineering Polymers, USA

The new Hard Cap™ Safety Chisel features a cap made of Zytel® that provides several safety and performance features. The Zytel® cap helps eliminate flying sparks, metal debris and other adverse effects while doubling the striking surface to not only protect the user in case of a non-direct hit, but also to increase the user's confidence when striking the chisel.

Furthermore, the cap buffers the steel-to-steel contact to reduce peak vibration by nearly 90 percent and noise by approximately 80 percent.

"The net result is a line of chisels and punches that is safer and requires less effort to achieve its end goal of breaking through a variety of materials, including concrete and steel," said Baltimore Toolworks owner Harry "Downie" McCarty.

"As a result, workers are better protected from vibration-related injuries and hearing loss.

The Hard Cap™ Safety Chisel line, by Baltimore Toolworks, revolutionizes the hand-struck tool industry with a cap made of DuPont™ Zytel®, which improves striking and cutting efficiency and improves user safety.

"We've reinvented this centuries-old tool with an elegantly-simple solution that in actual fact required significant design, engineering and materials knowledge and capability," said McCarty.

"Our two greatest challenges were in materials and design. We had to find a material strong enough to withstand constant pounding – but it couldn't be soft because that would absorb the impact. On the design side, the geometry had to be exact and the radius of curvature inside the cap had to be generous so that the impact force would pass through and the cap could stand up to some rather crushing hammer blows."

While the brainchild of McCarty, he forged a team that included consultant Dr Peter Popper, engineering students from the University of Delaware led by Dr James Glancy, Professor of Mechanical Engineering and Bioresources Engineering, and DuPont Engineering Polymers.

Ultimately, a Zytel® grade, which has an Izod notched impact strength in the 13 KJ/m² range and a flexural modulus of 290 kpsi (2 GPa), both at 50 % r.h., was proven to have the essential properties needed for this application.

This Zytel® grade is a high-modulus polymer that absorbs only a small amount of the impact of the strike, and is not as brittle as some other resins in the same stiffness range. The combination of the material selection and the geometry and design of the cap and chisel accounts for the increased functionality of the tool.

By changing the chisel's blade angle from 65 degrees to 60 degrees, the Hard Cap chisel actually achieves a higher level of efficiency than a traditional chisel without impacting reliability. "In the end, we were able to redesign the angle of impact with the cap so that the tool is actually much safer, more productive and differentiated in an otherwise commoditized market," concluded McCarty.

CONTACT

Baltimore Toolworks
PO Box 27149
Baltimore
MD 21230
USA
Tel: +1 410 752 5297
Email: sales@baltimoretool.com
www.baltimoretool.com

Zytel® replaces metal for tough and durable roof clip

The introduction of the Dimondek 630® roof profile to the New Zealand market by steel roofing manufacturer Dimond® has seen a remarkable change in the design of large commercial buildings, which can now incorporate much longer lengths of single sheet roofing. Integral to the success of the new product is its use of a polymer roof clip, made of glass-reinforced DuPont™ Zytel® nylon, which, while replicating the strength of its metal predecessor, offers numerous additional benefits in terms of ease-of-use and long-term performance.

By Richard Wood, DuPont Engineering Polymers, New Zealand

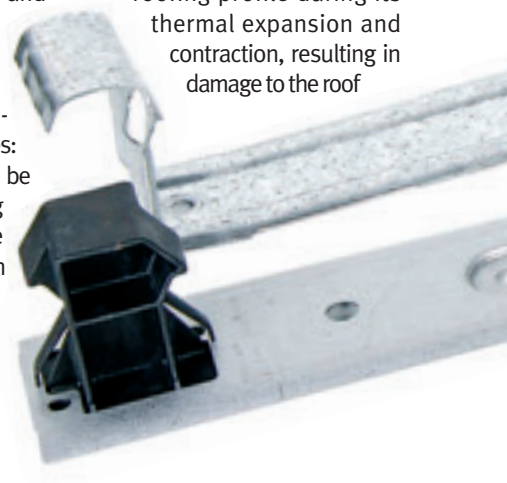
The Zytel® clip system was first used at a winery building in Blenheim, New Zealand, belonging to Delegat's Wine Estate Ltd. Operational since March 2006, roof sheets on this building measure up to 65 meters (approximately 197 feet).

The current New Zealand record for a single length of steel roof sheeting stands at 65.5 metres (almost 215 feet), used on the roof of a fresh-produce distribution facility belonging to Turners & Growers Ltd, Christchurch, in 2005. It is made with Dimondek 630, a concealed fixed roofing profile, which can be manufactured onsite to allow the production of roofing sheet lengths, without step joints, that are longer than those previously possible.

According to Proarch Architects of Palmerston North (New Zealand), familiar with Dimondek 630 from other projects, the benefits of uninterrupted sheets of roofing are numerous: "They allow freedom of design not previously possible, such as gutter to gutter sheets in a continuous draped curve. Plus with no breaks and no screw holes through the roof, leaks are eliminated and the roof lasts longer," explains Mike Swann of Proarch.

Yet as the roofing sheets have lengthened, so have the requirements for a fixing technology that could ensure the strength and durability of the Dimondek 630 system. "When using metal clips with long sheets of Dimondek 630, we encountered a number of issues: Firstly, the metal clips could be stretched laterally during installation, resulting in the loss of sheet alignment within the roof.

Secondly, the screw heads holding the clips to the roofing structure could interfere with the roofing profile during its thermal expansion and contraction, resulting in damage to the roof



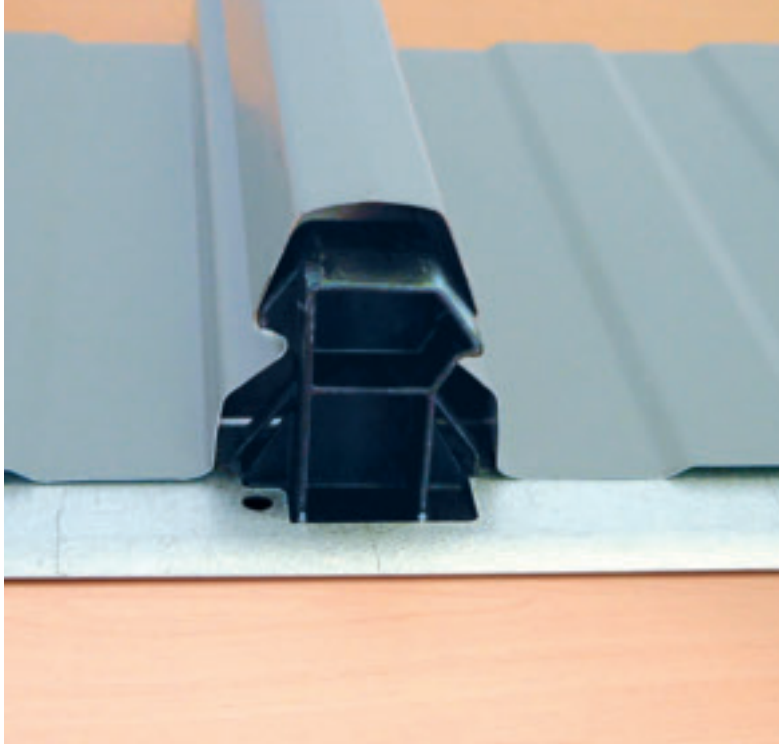
sheets and potential wear through and leakage in the long term. Thirdly, since the expansion and contraction of the roofing profiles could be as much as 30 mm (1.18 in), significant wear could potentially be caused to the roof at the point of engagement with the sharp edges on the metal roof clip. Finally, as the metal clips were imported from overseas, there were some delivery issues," explains Ian McClew, innovation manager at Dimond, New Zealand's largest manufacturer of steel roofing, cladding, structural and rainwater products and the company behind Dimondek 630.

In its quest for a solution, Dimond turned to Koves Plastic Industries Ltd., a plastic injection molding company offering precision engineering components and non-metallic solutions, in March 2005. "Our ability to innovate offers us a competitive advantage and a unique status in the New Zealand plastics industry, and hence we have incorporated metal replacement as a core business activity," says Sumanth Devara, business development manager at Koves Plastic Industries Ltd.

Koves has intimate knowledge of the DuPont portfolio of high-performance engineering polymers, having used them in its products for over 35 years.

Indeed it was close collaboration between Koves and DuPont Engineering Polymers in New Zealand that resulted in Dimond switching to a polymer clip. Together, Koves and DuPont overcame initial concerns at Dimond regarding the durability and tensile strength of polymer clips versus their metal counterparts, particularly at sub-zero temperatures.

As a result of extensive support from DuPont New Zealand, including material selection and laboratory testing on the material flow in molded components to assess their strength, Koves was able to produce a clip made of glass-reinforced DuPont™ Zytel® with a load bearing ability of 5.4 kN (kilonewtons), representing a safety factor of four – twice Dimond's original specification. The clip's centre wall, side ribs and base are also optimized to achieve maximum tensile strength and avoid lateral movement, at the same time facilitating the thermal expansion and contraction of the roofing profile. A patent covering its design and production has been applied for in New Zealand and Australia.

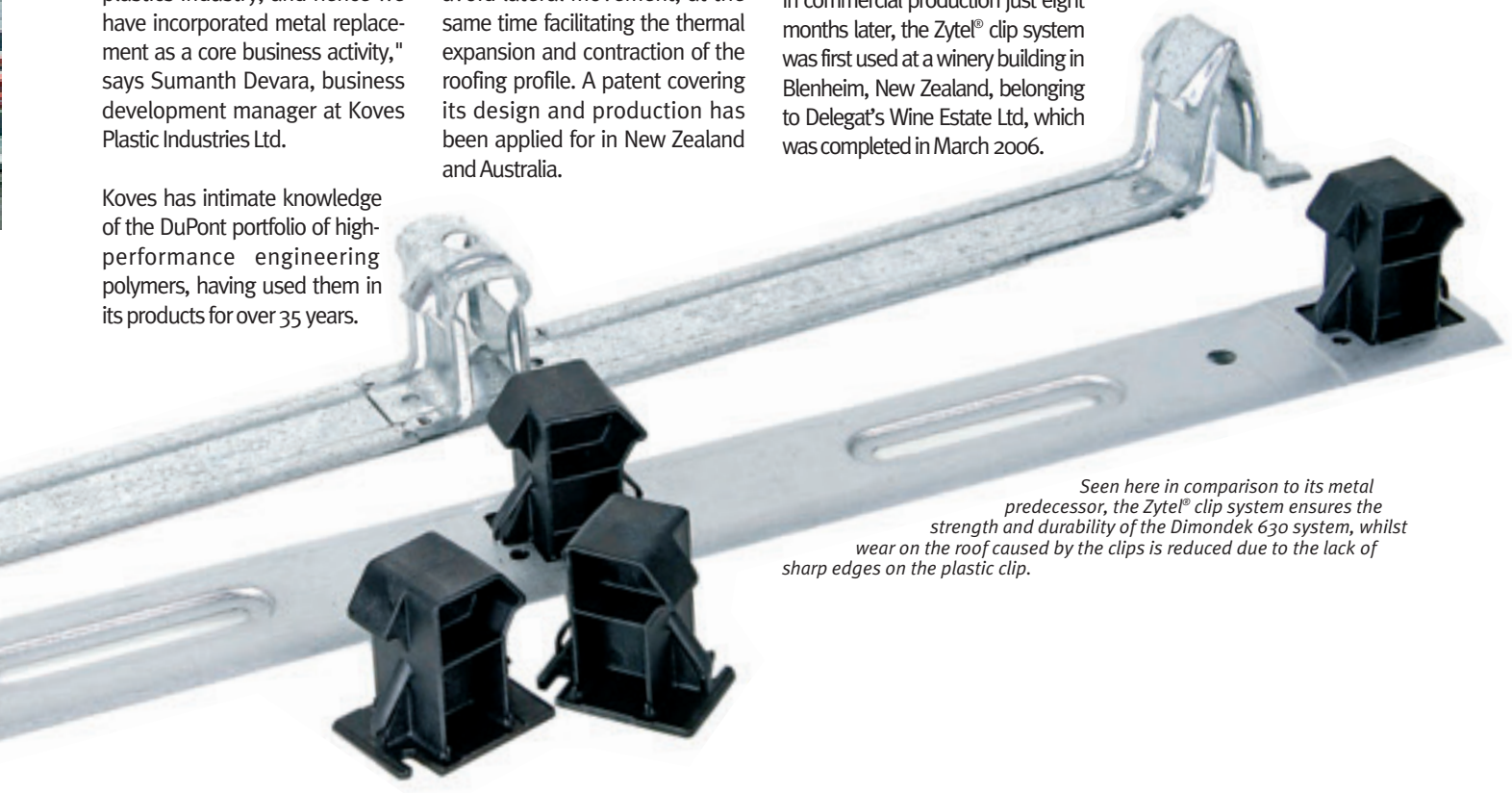


The black nylon clip is held in place on the steel strip by self-locking wings integrated in the clip's design, whilst the holes for securing the steel strip onto the roof structure were carefully defined to avoid screw-head interference with the steel roof profile.

The use of carbon-black-free Zytel® avoids corrosion issues with the zinc aluminum-coated steel roof, while wear on the roof caused by the clips is reduced due to the lack of sharp edges on the plastic clip. Meanwhile the locations where the clips are screwed onto the roof structure are carefully defined to avoid screw-head interference with the steel roofing profile.

In commercial production just eight months later, the Zytel® clip system was first used at a winery building in Blenheim, New Zealand, belonging to Delegat's Wine Estate Ltd, which was completed in March 2006.

During this and subsequent projects, the newly-designed clip system has proven itself to provide ease-of-use: three black clips are easily pushed into a pre-punched steel strip the width of a roof sheet (675 mm or 26.5 in), and are held in place by self-locking wings integrated in the clip's design.



Seen here in comparison to its metal predecessor, the Zytel® clip system ensures the strength and durability of the Dimondek 630 system, whilst wear on the roof caused by the clips is reduced due to the lack of sharp edges on the plastic clip.

Koves Plastic won the Bronze Award in the Building Category for its development of the Dimond Roofclip at the Plastics New Zealand Design Awards in October 2006. Pictured with the award are (left to right) Andrew Weisz Koves – Managing Director at Koves, Tony Rallis - Commercial Sales Manager at Dimond, Sumanth Devara – Business Development Manager at Koves and Ian McClew - Innovation Manager at Dimond.

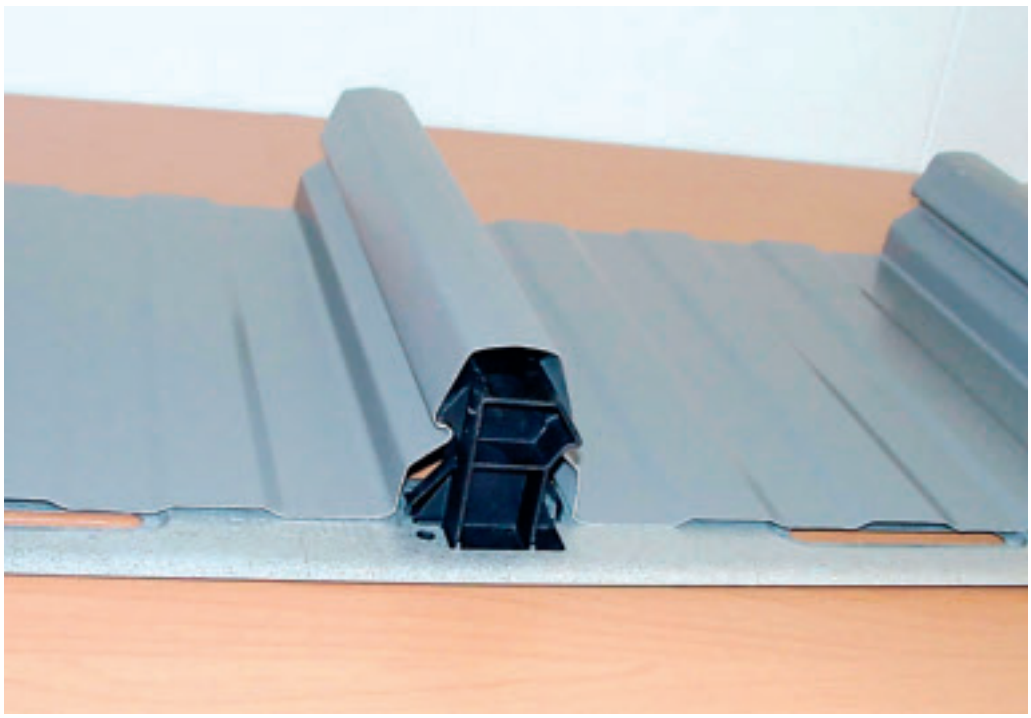
Each strip is then joined positively to the next to maintain exact sheet cover and positioning, and screwed onto the roof structure. Finally, the roof profile is locked in place by pushing the pre-formed upstands in the profile onto the clips.

Maurice Tusa from roofing contractor H.W. Coyle Ltd, who has worked with the new clip system on three commercial roofing projects to date, is convinced of its merits: "The installation of Dimondek 630 roofing using the Zytel® clip system has proven to be trouble-free, and has definitely enabled time saving in laying the roof due to its consistency and accuracy."

Yet it is in its strength and ability to cater for the ground-breaking sheet lengths made possible by Dimondek 630 that the new Zytel® clip system has succeeded the most. "The development of the plastic clip for our Dimondek 630 roof system has enabled us to specify 65 m (213 ft) lengths of metal roofing on several key projects completed to date.

"We can even recommend the system for roof lengths up to 100 m (328 ft) without the concern that the clip will wear away the roof sheet due to thermal expansion and contraction, and without the need to set up a manufacturing process to form a complicated metal clip to deliver the same performance," summarizes Ian McClew.

Industry recognition for the Zytel® roof clip system has followed: during October 2006, Koves Plastic Industries won the Bronze Award in the Building Category for its development of the Dimond roof clip at the Plastics New Zealand Design Awards.



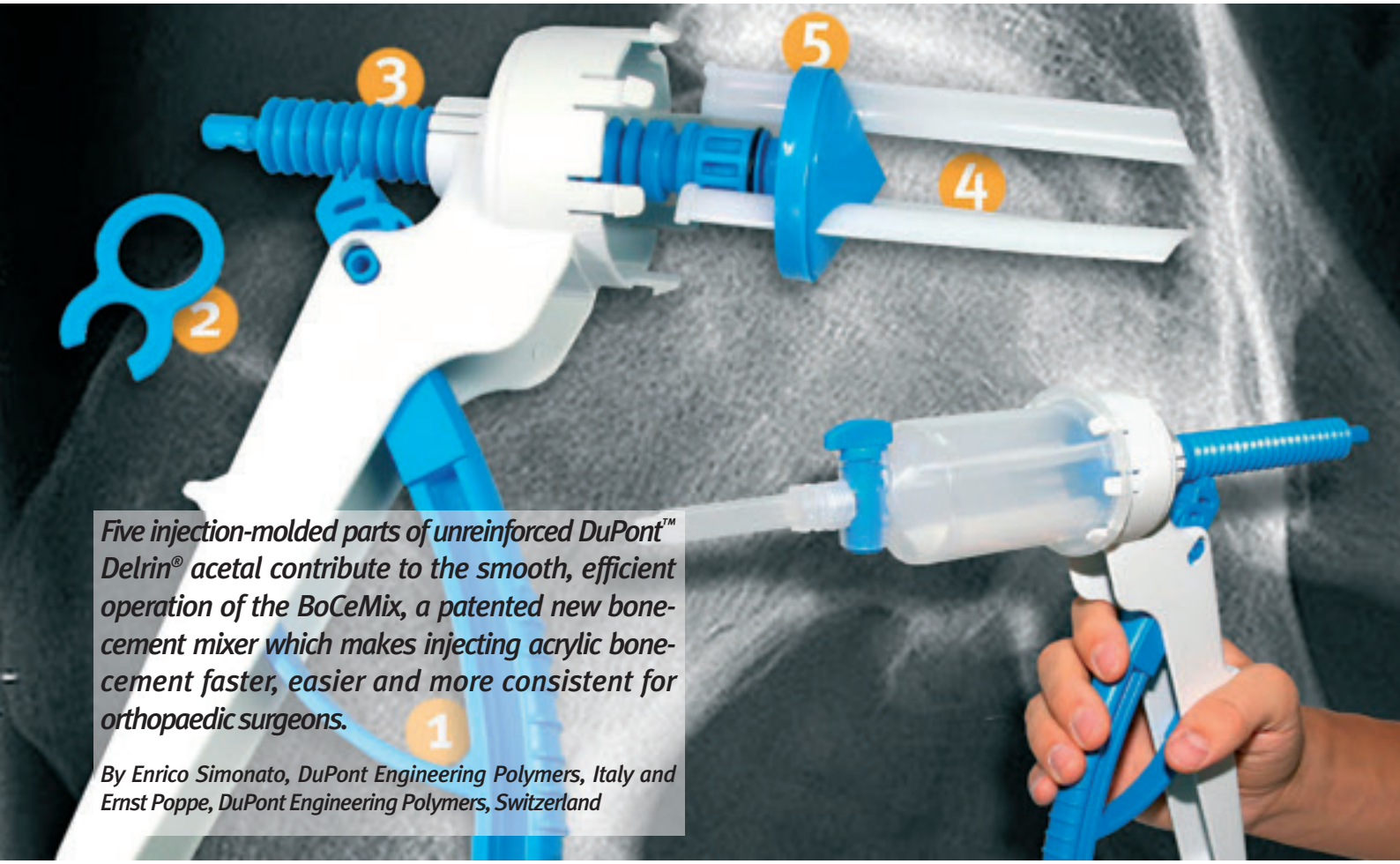
Three Zytel® clips are inserted through a steel strip the width of a single roof sheet, before the sheet itself is locked in place by pushing the pre-formed upstands in the profile onto the clips.

CONTACT

Koves Plastic Industries Ltd,
Onehunga,
Auckland,
New Zealand.
Tel.: +64 (09) 6344410
Fax: +64 (09) 6342649
Email: sumanth@koves.co.nz
www.koves.co.nz

Dimond,
48 Victoria Street,
Onehunga,
Auckland,
New Zealand.
Tel.: +64 (09) 634 0575
Fax: +64 (09) 634 6231
dimond.co.nz

Five parts of Delrin® in new bone-cement mixer



Five injection-molded parts of unreinforced DuPont™ Delrin® acetal contribute to the smooth, efficient operation of the BoCeMix, a patented new bone-cement mixer which makes injecting acrylic bone-cement faster, easier and more consistent for orthopaedic surgeons.

By Enrico Simonato, DuPont Engineering Polymers, Italy and Ernst Poppe, DuPont Engineering Polymers, Switzerland

Five injection-molded parts of unreinforced DuPont™ Delrin® acetal contribute to the smooth, efficient operation of the bone cement mixer from Bidoia: (1) a leaf-spring as an integral part of the trigger lever; (2) the C-shaped antiscrew pull tab; (3) the ribbed driving shaft; (4) the mixing blades and (5) the piston.

BoCeMix is a new bone-cement mixer developed by Bidoia S.a.s. of Peraga di Vigonza, near Padua, Italy. DuPont acetal resin's good elongation at yield makes it possible to mould a leaf-spring as an integral part of the trigger lever, thus eliminating the need for a metal return-spring and related assembly operations. The C-shaped anti-screw pull tab is held in place with a snap-fit, made possible by the acetal's combination of toughness and stiffness. The ribbed driving shaft relies on the inherent lubricity of Delrin® together with its high modulus and strength, which the ribbing requires; the mixing blades perform their task thanks to the material's flex modulus. The rotary piston is also made of Delrin®.

These parts in Delrin® would not have been feasible, or would have been more costly, if designed in metals or other materials, according to Dottore Roberta Bidoia of the company bearing her name.

According to Bidoia, the BoCeMix offers many attractive features. These include:

- faster cement preparation time,
- improved mixing quality,
- almost complete elimination of air and gas bubbles from the mixed cement,
- operation under permanent vacuum.

The mixer is a self-contained system, so there is no need for a separate injector. It is suitable for all types of cement (with some limitations for zirconium dioxide cement). Mixing can be done manually or with an electric power source. The transparent barrel allows visual inspection of the consistency of the cement.The combination of characteristics of unreinforced Delrin® acetal resin that made this design possible include a blend of toughness and stiffness, high tensile strength, dimensional stability and a low-friction surface.

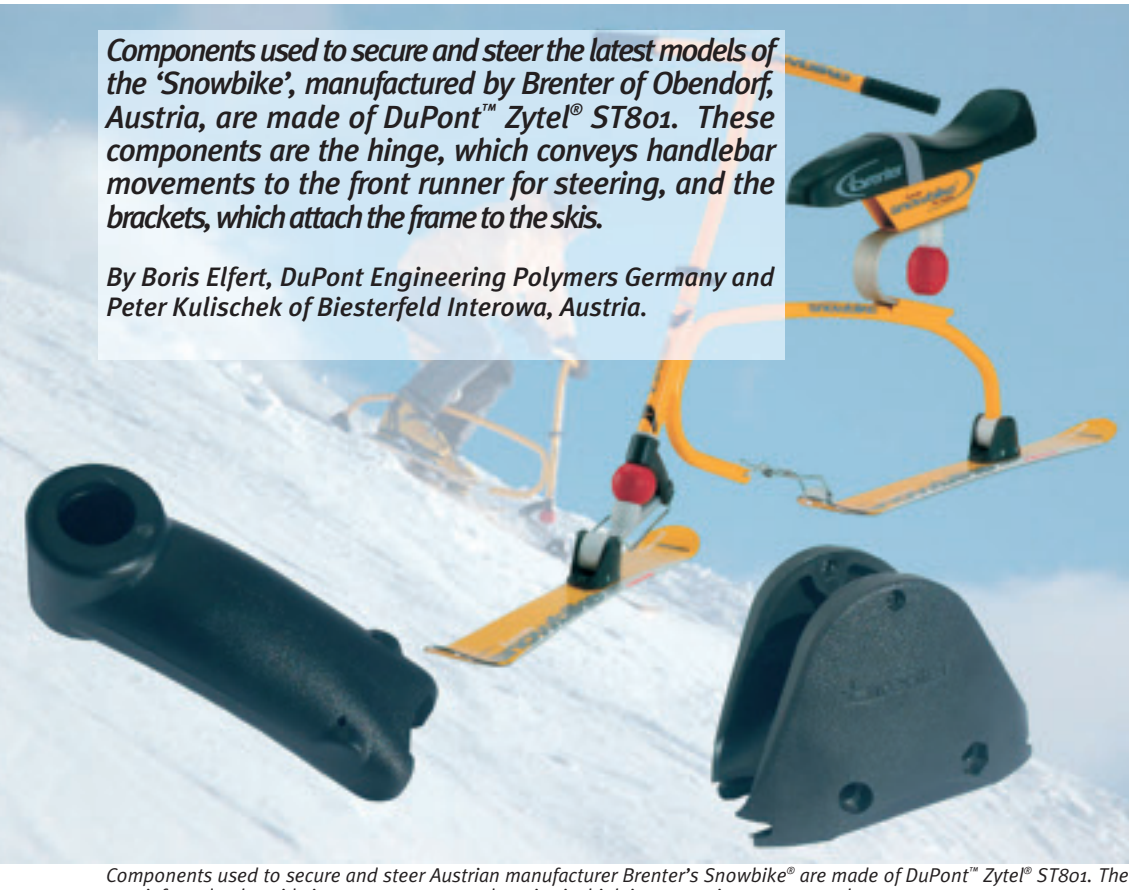
Bidoia, established in 1946, is a supplier of medical devices and instruments to doctors, hospitals and surgeons. The company's product portfolio includes osteosynthesis and laparoscopy equipment.

Apart from Delrin® acetal resin, DuPont Engineering Polymers supplies a wide range of engineering thermoplastics for a broad range of uses, including special control and premium control grades for the healthcare industry.

CONTACT

Bidoia S.a.s.
18 via dell'Artigianato
35010 Padova
Peraga di Vigonza
Italy
Tel: +39 049 893 0259
Fax: +39 049 8930 004
Email: bidoia@bihos.com
www.bidoia.com

Zytel® ST801 provides stability for snowbike



Components used to secure and steer the latest models of the 'Snowbike', manufactured by Brenter of Obendorf, Austria, are made of DuPont™ Zytel® ST801. These components are the hinge, which conveys handlebar movements to the front runner for steering, and the brackets, which attach the frame to the skis.

By Boris Elfert, DuPont Engineering Polymers Germany and Peter Kulischek of Biesterfeld Interowa, Austria.

Components used to secure and steer Austrian manufacturer Brenter's Snowbike® are made of DuPont™ Zytel® ST801. The unreinforced polyamide is easy to process and retains its high impact resistance even at low temperatures.

Brenter 'Snowbikes', a newly-popular form of winter sports equipment, can be hired from 120 'Snowbike' Rent&Learn centers in Japan, USA, Canada, Argentina and Europe. Commenting on the tough conditions the snowbike endures, Bernd-Eric Brenter said: "The demands put on the materials are extreme: sub-zero temperatures, UV exposure at 3,000 metres, temperature variations from +20 degrees C in the hire shops to –40 degrees C on the slopes and wind and weather exposure."

Zytel® ST801 is an unreinforced, high-impact resistant polyamide that retains its mechanical properties – even at sub-zero temperatures. It is thus an established material for winter sports and other sports equipment where resistance to blows and other impact is a priority. Furthermore, the material is weather- and scratch-resistant, and provides an attractive surface finish.

The excellent processability of Zytel® ST801 was a further decisive factor in Brenter's material selection. It is highly suited for use in thick-walled, injection-molded parts, such as those used in the 'Snowbike'. There is negligible warpage during cooling, whilst the risk of material deficiencies caused by voids and sink marks is minimized. Original plans foresaw only the hinge being made of polyamide.

Following the company's positive experience with the material in terms of its properties and processing performance, it extended its application to the two securing brackets.

Brenter was supported in the choice of materials used for these components by Biesterfeld Interowa, the distributor of DuPont engineering polymers in Austria, and Austrian plastics molder Seletec Plastic Products GmbH & Co KG. For Biesterfeld Interowa, Zytel® polyamide was the first-choice material from the start. The only question was whether a reinforced or unreinforced grade would be used to provide the components with the necessary strength and stability. Tests showed that the unreinforced grade of Zytel® ST801 fully met the specification.

A 'Snowbike' is equipped with handlebars and a saddle, much like a bicycle. Instead of wheels it uses two runners. The snowbiker has two short skis on his or her feet for increased stability when taking steep curves. Company founder Engelbert Brenter invented the 'sitting ski' in 1949, which became known as the highly popular 'ski-bob' during the 1960s and early 1970s. During the mid-1990s the sport experienced a renaissance as the grandson of the company founder, Bernd-Eric Brenter, revamped and modernized the old design and marketed it in America under the name of 'Snowbike'. In recent years, Brenter's 'Snowbike' has been gaining an increased following of European fans.

CONTACT

Brenter GmbH
Arnsdorferstr. 19-23
5110 Oberndorf
Austria
Tel: +43 62 72 77 77
Email: info@snowbike.com
www.snowbike.com

Seletec Plastic Products GmbH & Co. KG,
Tobersbach 66
5723 Uttendorf
Austria
Tel: +43 6563 200 15
Email: g.rauch@seletec.com
www.seletec.com

Biesterfeld Interowa GmbH & Co. KG
Bräuhausgasse 3-5,
1050 Vienna
Austria
Tel: +43 1 512 3571-0
Email: peter.kulischek@interowa.at
www.interowa.com

Added safety for Puma motorcycle boot with Hytrel®

The latest motorcycle boot from Puma, named '1000', was developed by the world-renowned sporting goods manufacturer for both the professional racer and the hobby biker. A core element of the boot's design is an adjustable clamp made of a stiff yet elastic grade of DuPont™ Hytrel® thermoplastic polyester elastomer.

By Laurent Hanen, DuPont Engineering Polymers, France

A clamp made of stiff yet flexible DuPont™ Hytrel®, a feature of the new '1000' high-performance motorcycle boot from Puma, prevents the ankle from twisting to an 'angle of no return' in the event of an accident, without restricting movement.

Hytrel® thermoplastic elastomer combines particularly elastic deformation behavior with a high degree of protective support for the ankle in the event of an accident. Aesthetic appeal was a further reason behind Puma's selection of the material for its lastest '1000' motorcycle boot: easy-to-process Hytrel® is not only simple to color to customer requirements, but the injection-molded part provides a scratch-resistant, high-gloss surface without the need for secondary treatment.

The safety clamp arches over the ankle whilst covering the lower part of the shin. This provides optimal support for the ankle joint in both its medial and lateral movement. Yet, thanks to the elasticity of Hytrel® and the unique form of the bearing employed, the foot remains unrestricted in its movement. An integrated catch limits the foot's rotation to within a 'safe' degree. Thus the safety clamp, thanks primarily to the high stiffness of the Hytrel® 6356 grade, prevents the ankle joint from turning beyond the medically-defined "angle of no return". An additional shock-absorber in the heel reduces the effect of vertical blows, thus limiting the levels of compression placed on the ankle/lower shin area during high-speed crashes.

According to Thomas Fricke, development manager for shoes at Puma: "This innovative safety device acts effectively as a so-called 'Ghost Doctor™', only coming into play when it is required to prevent imminent injury. The all-round protection provided by the device is a result of the ideal combination of properties of Hytrel® 6356 for this application. During comprehensive testing, this grade best fulfilled all requirements in terms of elasticity, impact resistance, strength and stiffness, as well as demonstrating flexural fatigue strength in hot, cold, wet and dry conditions. This means for the motorcycle rider that his boots will respond consistently in all types of conditions, at any time of the year."

According to Thomas Fricke, and as a result of the positive market response to the company's new safety feature, Puma will apply the same feature to future motorcycle boots within its range. "Two factors are important during material selection: the material properties and the technical advice provided to exploit these properties to the benefit of our motor-sport customers. Both of these elements were provided by DuPont."

Hytrel® thermoplastic elastomer combines the elastic properties of rubber with the processing-ease of thermoplastics, either by way of injection-molding or extrusion. It is ideal for parts requiring low flex fatigue and high stress resistance. Both tear and tear propagation strengths are high, it is creep- and abrasion-resistant, and Hytrel® retains these properties, as well as further mechanical properties, at temperatures between -40 degrees C and +110 degrees C. The high-performance grade used by Puma, Hytrel® 6356, is well-known for its particularly high stiffness. Typical applications for Hytrel® include sporting goods such as tension straps and other components of shoes and ski boots.

Puma high-performance motorcycle boots protect the feet of over 50 professional racers from around the world including Randy de Puniet, Alex Hofmann and Jose Luis Cardoso – three of the 22 competitors in the 2006 MotoGP World Championship.

CONTACT

Puma AG Rudolf Dassler Sport
Würzburger Str. 13
91074 Herzogenaurach
Germany
Tel: +49 9132 810
Email: info@puma.com
www.puma.com

DuPont success at 2006 SPE Awards (Auto Division)

An innovative new wide band resonator using DuPont™ Zytel® nylon 66 captured the 2006 'Most Innovative Use of Plastics' Award in the powertrain category from the Society of Plastics Engineers (SPE) Automotive Division. And a sliding truck window that mounts flush with the aid of DuPont™ Rynite® and Delrin® captured the 'Most Innovative Use of Plastics' Award in the Performance and Customization category of the same SPE division.

By Chris Murphy, Automotive Director, Americas, DuPont Automotive Performance Materials

The turbo resonator, developed by Woco Motor Acoustics using Zytel®, eliminates insulation materials by integrating high- and low-frequency attenuating parts into a single assembly while silencing 'turbo whine'.

The 2007 Dodge Nitro 2.8L Turbo Diesel sports a unique wide-band resonator from Woco Motor Acoustic Systems USA Inc. that captured top honors in SPE's 'Most Innovative Use of Plastics' Award in the powertrain category. Made with DuPont™ Zytel® nylon 66, this breakthrough resonator silences 'turbo-whine', eliminates insulation material for significant cost savings and improves durability by integrating injection-molded high- and low-frequency attenuating parts into a single assembly. The integrated component is extendable to any charged or uncharged air induction system. "Wide-band silencing technology increasingly is used to help eliminate induction noises in the engine department," said Udo Gärtner, vice president of Woco Motor Acoustics Inc. "A wide-band silencer – which places several resonating chambers in a series to filter unwanted frequencies – is truly an innovative way for automakers to tune the sound they desire."

This new resonator reduces both high-and low-frequency noise to help automakers meet higher standards for pass-by noise emissions, such as those in Japan and Europe. Additionally, since the resonator attenuates noise at the source, additional insulation material becomes redundant, leading to significant cost savings.

Guardian Industries' flush-mount sliding rear window for pickup trucks captured the 'Most Innovative Use of Plastics' Award in the Performance and Customization category of SPE's Automotive Division Awards event. The window's innovative design keys on the performance and design freedom afforded by DuPont™ Rynite® PET thermoplastic polyester and DuPont™ Delrin® acetal resin. "The sleek flush-mount design of our HPS G-1.0 window represents a major styling and functional advance over other sliding truck windows," said Phil Taylor, Guardian's product marketing manager for the new unit. Other designs, which use metal rails, have an overlap of the center panel and fixed rear panels when in the closed position. The sliding truck window is available in the U.S. automotive after-market for GMC Sierra and Chevrolet Silverado pickups. Versions for Ford F150 and Dodge Ram trucks are due out in March 2007. The new window has upper and lower guide rails molded from Rynite® PET. Their design is crucial to the window's innovative flush-mount feature with guide channels that have an angled change of direction near each side of the window opening. The angled channel guides the sliding center window assembly into alignment with the fixed window as it closes. The slider's glass pane is framed in a one-piece carrier, also molded from Rynite®.

Guardian Industries' innovative, flush-mount sliding window uses a rail and center pane carrier molded from Rynite® PET and guides made of low-friction Delrin®.

The slider assembly is held in the rail by guide components mounted at the top and bottom of the carrier. Molded from Delrin® 100AL, formulated for especially low-friction properties, the guides travel smoothly in channels in the upper and lower rails made of Rynite®. The upper guides are spring-loaded to maintain their position in the upper rail's channel. Delrin® 100AL also provides the good strength, stiffness and dimensional stability required for the guide components.

CONTACT

Woco Motor Acoustic Systems, Inc.
23031 Sherwood Ave.
Warren, MI 48091
USA
Tel: +1 586 427 3838
email: info@de.wocogroup.com
www.wocogroup.com

Guardian Automotive Corporation
23751 Amber Avenue
Warren, MI 48089
USA
Tel: +1 586 757 7800
www.guardian.com/en/contact.html
www.guardian.com

Delrin® and Zytel® provide stability and safety for high-tech ski-binding

All polymer-based components of new Diamir touring and freeride ski bindings, from Fritschi AG Swiss Bindings of Switzerland, are made of either Delrin® acetal resin or Zytel® polyamide from DuPont.

By Wolfgang Lehr, Biesterfeld Plastic Suisse and Boris Elfert, DuPont Bad Engineering Polymers, Geneva.

Fritschi Swiss Bindings' Diamir touring and freeride bindings meet today's highest requirements in terms of quality and reliability, thanks to the use of DuPont™ Delrin® and Zytel®.

All polymer-based components of the new Diamir touring and freeride ski bindings, from Fritschi AG Swiss Bindings of Reichenbach, Switzerland, are made of engineering polymers from DuPont. High requirements in terms of reliability and safety meant the Swiss manufacturer turned to a highly impact-resistant grade of DuPont™ Delrin® acetal resin and two specially modified impact-resistant and glass-reinforced grades of DuPont™ Zytel® nylon. According to Martin Jordi, technology manager at Fritschi: "We have relied upon Delrin® and Zytel® for our bindings for many years. When selecting the materials to be used for the manufacture of our innovative high-tech bindings, we look to combine a high degree of safety, functionality and comfort in an attractive design, with a reduced overall weight."

Biesterfeld Plastic Suisse GmbH, DuPont's Swiss distributor, provided support in both material selection and manufacturing optimization.

The highly impact-resistant grade of Delrin® is used for those components requiring low friction. The glass-reinforced Zytel® is used in the part that transmits energy from the binding to the ski, whilst the high-impact Zytel® grade is used for all other polymer parts. All the materials retain their strength and impact resistance at low temperatures – a mandatory requirement for sports equipment. They also offer a high level of UV stability and weathering resistance, are scratch proof and provide a good surface finish. During use, the surface remains largely ice-free, ensuring safety even under the worst external conditions.

Thus the Diamir touring and freeride bindings meet today's highest requirements in terms of quality and reliability. Extreme conditions such as increased UV exposure at high altitudes, temperatures well below freezing and varying mechanical loads during mountain ascent or descent pose no problem to the bindings.

Fritschi has developed and produced high-quality binding systems for touring, freeride and alpine skiers since it was founded in 1960. The new Diamir Freeride Plus won the European Ski Award 2006 at the ISPO trade show in spring 2006. The so-called Power Transmission Control (PTC) in the binding combines a direct transmission of power and stability for excellent descent performance with a comfortable 'walking' function. Energy is transmitted from the shoes to the edges of the skis; at the front of the binding through a stable mounting bracket and at the rear through the new PTC mounting plate – actively supported by a unique, free-gliding central bar system that allows the ski to flex naturally so that the skis can be guided along easily and accurately. Despite its light weight, approximately 2,000 g (64.3 oz), it offers the safety performance of a high quality alpine binding.

CONTACT

Fritschi AG Swiss Bindings
Hauptstr.
CH-3713 Reichenbach
Switzerland
Tel: +41 33 672 144
Email: info@fritschi.ch
www.fritschi.ch

Biesterfeld Plastic Suisse GmbH
Dufourstr. 21
Postfach 14695
4010 Basel
Switzerland
Tel: +41 61 201 3150
Fax: +41 61 201 3169
Email: info@biesterfeld.ch
www.biesterfeld.ch

EUROPE/MIDDLE EAST/AFRICA

Belgique / België
Du Pont de Nemours (Belgium)
Antoon Spinoystraat 6
B-2800 Mechelen
Tel. +32 15 44 14 11
Telefax +32 15 44 14 09

Bulgaria
Serviced by
Biesterfeld Interowa GmbH & Co. KG.
See under Österreich.

Ceská Republika a
Slovenská Republika
Du Pont CZ, s.r.o.
Pekarska 14/268
CZ-155 00 Praha 5 – Jinonice
Tel. +42 257 41 41 11
Telefax +42 257 41 41 50-51

Danmark
Du Pont Danmark ApS
Skjøtevej 26
P.O. Box 3000
DK-2770 Kastrup
Telefax +45 32 47 98 05
Telefax +45 32 47 98 05

Deutschland
Du Pont de Nemours
(Deutschland) GmbH
DuPont Straße 1
D-61343 Bad Homburg
Tel. +49 6172 87 0
Telefax +49 6172 87 27 01

Egypt
Du Pont Products S.A.
Bldg no. 6, Land #7, Block 1
New Maadi
ET-Cairo
Tel. +202 754 65 80
Telefax +202 516 87 81

España
Du Pont Ibérica S.A.
Edificio L'Illa
Avda. Diagonal 561
E-08029 Barcelona
Tel. +34 227 60 00
Telefax +34 227 62 00

France
DuPont de Nemours (France) SAS
Défense Plaza
23/25 rue Delarivière Le Foullon
Défense 9
92 064 La Défense Cedex
Phone: +33 (0)1 41 97 44 00
Telefax +33 1 47 53 09 67

Hellas
Biesterfeld Hellas Intralink S.A.
Trading Establishment
149, AG. Triados Menidi Acharnes
GR-13671 Athens
Tel. +30 210 24 02 900
Telefax+30 210 24 02 141

Israël
Gadot Chemical Terminals (1985) Ltd.
16 Habonim Street
Netanya – South Ind. Zone
IL-42504 Netanya
Tel. +972 3 526 42 41
Telefax +972 3 528 27 17

Italia
Du Pont de Nemours Italiana S.r.L.
Centro Direzionale "Villa Fiorita"
Via Piero Gobetti, 2/A
20063 Cernusco s/N (MI)
Tel. +39 02 92629.1 (switchboard)
Fax +39 02 36049379

Magyarország
DuPont Magyarország Kft.
HU - 2040 Budaörs
Neuman J.u. 1
Tel. +36 23 509 400
Telefax: +36 23 509 432

Maroc
Deborel Maroc S.A.
40, boulevard d'Anfa – 10°
MA-Casablanca
Tel. +212 227 48 75
Telefax +212 226 54 34

Norway / Norge
Distrupol Nordic
Ostenssjoveien 36
N-0677 Olso
Tel. +47 23 16 80 62
Telefax +47 23 16 80 62

Österreich
Biesterfeld Interowa GmbH & Co. KG
Bräuhausgasse 3-5
P.O. Box 19
AT-1051 Wien
Tel. +43 1 512 35 71-0
Fax +43 1 512 35 71-31
e-mail: info@interowa.at
internet: www.interowa.at

Polska
Du Pont Poland Sp. z o.o.
ul. Powazkowska 44C
PL-01-797 Warsaw
Tel. +48 22 320 0900
Telefax +48 22 320 0910

Portugal
Biesterfeld Iberica S.L.
Rua das Matas
P-4445-135 Alfena
Tel. +351 229 698 760
Telefax +351 229 698 769

Romania
Serviced by
Biesterfeld Interowa GmbH & Co. KG.
See under Österreich.

Russia
DuPont Russia LLC.
ul. Krylatskaya 17/3
121614 Moscow
Tel. +7 495 797 22 00
Fax. + 7 495 797 22 01

Schweiz / Suisse / Svizzera
Biesterfeld Plastic Suisse GmbH
Dufourstrasse 21
Postfach 14695
CH-4010 Basel
Tel. +41 61 201 31 50
Telefax +41 61 201 31 69

Slovenija
Serviced by
Biesterfeld Interowa GmbH & Co. KG.
See under Österreich.

Suomi / Finland
Du Pont Suomi Oy
Box 62
FIN-02131 Espoo
Tel. +358 9 72 56 61 00
Telefax +358 9 72 56 61 66

Sverige
Serviced by
Du Pont Danmark ApS.
See under Danmark.

Türkiye
Du Pont Products S.A.
Buyukdere Caddesi No. 122
Ozsezen Ismerkezi, A block, Kat: 3
Esentepe, 34394 Istanbul
Tel. +90 212 340 0400
Telefax +90 212 340 0430

Ukraine
Du Pont de Nemours
International S.A.
Representative Office
3, Glazunova Street
Kyiv 252042
Tel. +380 44 294 96 33 / 269 13 02
Telefax +380 44 269 11 81

United Kingdom
Du Pont (UK) Limited
Wedgwood Way
Stevenage
Hertfordshire SG1 4QN
Tel. +44 1438 734000
Telefax ++44 1438 734109

South Africa
DuPont de Nemours
Societe Anonyme
South African Branch Office
4th Floor Outspan House
1006 Lenchen Avenue North
Centurion
Pretoria 0046
Tel. +27 0 12 683 5600
Telefax +27 0 12 683 5661

NORTH AMERICA

USA
DuPont Engineering Polymers
Barley Mill Plaza, Building 26
P. O. Box 800026
Wilmington, Delaware 19880
Tel. +1 302 992 4592
Telefax +1 302 992-6713

DuPont Automotive
950 Stephenson Highway
P.O. Box 7013
Troy, MI 48007-7013
Tel. +1 248 583-8000

Canada
DuPont Engineering Polymers
P.O. Box 2200
Streetsville, Mississauga
Ontario, Canada L5M 2H3
Tel. +1 905 821-5953

SOUTH AMERICA

Argentina
Du Pont Argentina S.A.
Avda. Mitre y Calle 5
(1884) Berazategui-Bs.As.
Tel. +54 11 4239-3868
Telefax +54 11 4239-3817

Brasil
DuPont do Brasil S.A.
Al. Itapecuru, 506 Alphaville
06454-080 Barueri-Sao Paulo
Tel. + 5511 7266 8229

Mexico
DuPont S.A. de C.V.
Homero 206
Col. Chapultepec Morales
11570 Mexico D.F.
Tel. + 525 557 221 000

ASIA-PACIFIC

Australia
DuPont (Australia) Ltd.
168 Walker Street
North Sydney NSW 2060
Tel: +612 9923-6111
Fax: +612 9923 6011

Hong Kong/China
DuPont China Ltd.
26/F, Tower 6, The Gateway,
9 Canton Road
Tsimshatsui, Kowloon, Hong Kong
Tel: +852 2734 5345
Fax: +852 2724 4458

Shanghai/China
DuPont China Holding Co. Ltd.
15/F., Shui On Plaza
333 Huai Hai Road (Central)
Shanghai 200021
Tel: +86 21 6386 6366
Fax: +86 21 6386 6333

India
E.I. DuPont India Limited,
"Arihant Nitco Park" Sixth floor,
90, Dr. Radhakrishnan Salai,
Mylapore,
Chennai 600 004
Tel: +91 44 28472800
Fax: +91 44 28473800

Japan
DuPont Kabushiki Kaisha
Sanno Park Tower, 11-1
Nagata-cho 2-chome
Chiyoda-ku, Tokyo 100-6111
Japan.
Tel: +81 3 5521 8500
Fax: +81 3 5521 2595

Korea
DuPont (Korea) Ltd.
4/5 Floor, Asia Tower
#726, Yeoksam-dong, Kangnam-Ku
Seoul 135-082
Tel: +822 2222-5200
Fax: +822 2222-5470

Singapore
Du Pont Company (S) Pte Ltd
1 HarbourFront Place #11-01
HarbourFront Tower One
Singapore 098633
Tel: +65 6586 3688
Fax: +65 6272 7494

Taiwan
DuPont Taiwan Ltd.
Hung Kuo Building, 13th floor
#167 Tun Hwa North Road
Taipei 105
Tel: +8862 2719-1999
Fax: +8862 2719-0852

Thailand
DuPont (Thailand) Limited
6-7th Floor, M. Thai Tower
All Seasons Place
87 Wireless Road
Lumpini, Phatumwan
Bangkok 10330
Tel : +66 2 659 4000
Fax : +66 2 659 4001

CRASTIN® PBT
THERMOPLASTIC POLYESTER RESIN

DELRIN®
ACETAL RESIN

HYTREL®
THERMOPLASTIC POLYESTER ELASTOMER

MINLON®
MINERAL REINFORCED NYLON RESIN

RYNITE® PET
THERMOPLASTIC POLYESTER RESIN

THERMX® PCT
HIGH PERFORMANCE POLYESTER

TYNEX®
NYLON MONOFILAMENT

VESPEL®
PARTS AND SHAPES

ZYTEL®
NYLON RESIN

ZYTEL® HTN
HIGH PERFORMANCE POLYAMIDE

ZENITE® LCP
LIQUID CRYSTAL POLYMER

DUPONT™ ETPV
THERMOPLASTIC RUBBER THAT RESISTS OIL & HEAT

Publisher: Evelyne Schütz,
DuPont Engineering Polymers,
2, ch. du Pavillon
CH-1218 Le Grand-Saconnex
Geneva
Switzerland
Tel: +41 22 717 51 11
Fax: +41 22 717 52 00

Editor: Susan Gutmans,
SGA, Geneva

Layout & production: Johan Hedqvist,
Geneva

Engineering Design is published in English, French, German, Italian, Spanish and Russian by Du Pont de Nemours International S.A., P.O. Box 50, CH-1218 Le Grand-Saconnex, Geneva, Switzerland.

Printed in Switzerland

L-13836

www.plastics.dupont.com

To get Engineering Design in an e-format, go to http://www.engineeringpolymers.com/engdesign/

DUPONT
The miracles of science™