This article features a variety of materials that improve performance of products in many areas of everyday life.

Nylon bike wheel survives impact on rugged terrain

The new FRX5 bike wheel is made in a single piece of DuPont Zytel nylon resin by TAG Wheels, Newport Beach, Calif. A toughened glass-reinforced grade was chosen because it delivers excellent toughness, strength, and stiffness, says DuPont, Wilmington, Del. Wall sections vary in thickness to provide additional strength and stiffness where needed, and each spoke has an internal rib. The hub shell has thick walls, and it is keyed to optimize shear resistance and torque transfer. The design minimizes pinch flats with a relatively thick, flat-topped bead and a resilient rim. The rear wheel has an integral chain-catcher feature to combat chain binding.

The wheels are manufactured by a patented lost-core molding process that makes possible its complex geometry and strong hollow structure. The process starts with molding a metal mandrel from a low-melting-point alloy. This mandrel is then over-molded with the nylon, and is then melted out, leaving behind the hollow-formed composite wheel. http://www.tagwheels.com; www.plastics.dupont.com.

Stainless steel golf club has larger head volume

Callaway Golf Company has developed the Callaway Golf X Hot Fairway Wood, a new stainless steel design that builds off the Company’s line of X Fairway Woods. It features a larger head volume and a shallower face for increased forgiveness and confidence. The larger head volume allowed engineers to raise the moment of inertia significantly, making it both exceptionally stable and more forgiving. The X Hot Fairway Wood lives up to its name thanks to a face made of Carpenter 455 Steel, a lighter yet stronger alternative to traditional stainless steel. The result is faster ball speed off the face for distance unmatched by any other Callaway Golf fairway wood model. The X-Sole design allows the clubhead to rest on two distinct areas of the sole at address, eliminating the tendency of the head to rock back and forth at address.

The club also includes S2H2 (short
straight, hollow hosel), which helps to further increase discretionary weight by removing weight from the hosel; and Tru-Bore bore-through technology, which extends the shaft through the head to the bottom of the sole for clubhead control.

For more information: Jennifer Yang, Callaway Golf Co., 2180 Rutherford Road, Carlsbad, CA 92008; tel: 760/931-1771; www.callawaygolf.com.

Phase-changing material helps bicycle helmet to keep cool

A phase-changing material that absorbs heat as it changes from a solid to a liquid has been developed as a cooling system for bicycle helmets by researchers at the Fraunhofer Technology Development Group TEG in Stuttgart, Germany. The material changes from solid to liquid depending on the temperature, and thus prevents heat from building up. If the cyclist gets a hot head, the materials inside the helmet liquefy and soak up the heat. The temperature remains constant until all the molecules have changed into the liquid state. Called Movaero, the helmet consists of two helmets inside one another: a protective helmet and an aerodynamic cover. They are connected by a hinged joint.

The outer helmet cover is attached to the cyclist’s jersey with a Velcro fastener or a spring mechanism. If the cyclist lowers his head, the inner protective helmet follows his motion, while the outer cover stays where it is and continues to ensure optimum aerodynamics. The cyclist can repeatedly relax his neck muscles during the race without losing speed. Should the helmet not be needed for racing, the aerodynamic cover can be taken off.


Inline skates by Rollerblade feature frames of nylon

Rollerblade chose DuPont engineering polymers to provide the ultimate in slideability combined with abrasion-resistance for two new advanced-level inline roller skates, says DuPont, Wilmington, Del. For the frame of the high-end Point 8 model, Rollerblade designers chose DuPont Delrin acetal resin reinforced with DuPont Kevlar aramid.

The frame of the mid-range DT4 is injection-molded from DuPont Zytel 70G33GRA. This is a nylon 66 reinforced with 33% glass fiber, which boosts tensile strength, stiffness, and abrasion-resistance. In addition, it contains a lubricant, which lowers the friction coefficient to give better sliding action. For more information: DuPont Engineering Plastics, Wilmington, DE 19898; tel: 302/999-4592; www.plastics.dupont.com; www.rollerblade.com.

Polymer pistol has rigid stainless steel chassis

A full-size polymer pistol called the M&P45 has been developed by Smith & Wesson, says DuPont, Wilmington, Del. The M&P45 pistol features a DuPont Zytel polymer frame reinforced with a rigid stainless steel chassis and a through-hardened black melonite finished stainless steel barrel and slide. It has a passive trigger safety to prevent the pistol from firing if dropped, and a sear release lever that eliminates the need to press the trigger to disassemble the firearm. A loaded chamber indicator is located on top of the slide. The firearm also features an ambidextrous slide stop and a reversible magazine release, as well as an enlarged trigger guard designed to accommodate gloves.

Jet ski boat hulls engineered with nanosize laminated layers

A proprietary nano-engineered material called NanoXcel significantly increases performance by decreasing weight by 25%, says Yamaha Motor Corp. USA, Sandestin, Fla. Yamaha introduced
the NanoXcel hulls, decks, and liners on its new SHO and HO WaveRunner jet skis.

NanoXcel is a technology in which a “nano-created filler” is layered thousands of times over, making the bonding surface much larger and stronger than before. Therefore, much less filler is needed, resulting in a lightweight, stronger material that improves the power-to-weight ratio significantly and boosts responsiveness, acceleration, and top speed.

Yamaha says that it is the only manufacturer in the personal watercraft industry with full-scale high-compression molding capabilities. Every hull and deck is constructed to exact tolerances, maximizing strength and durability. Laser-guided water jets and advanced robotics ensure extreme precision. www.yamaha-motor.com.

Carbon fiber race bike is the lightest ever made

Three-time Tour De France Champion Greg LeMond and LeMond Bikes have introduced the lightest LeMond race bike ever, the Tête De Course. The 2008 model is an extension of the popular LeMond Carbon Triomphe platform. The Tête De Course, which means “head of the race,” builds on the Min-Max Design Theory, which minimizes frame weight while maximizing efficiency and performance, by placing more carbon fibers in areas requiring higher strength, and fewer fibers in areas requiring less strength.

The frame weighs 850 grams, and marks the first time a LeMond bike has gone sub-900 grams. To create the lightest, most efficient bike possible, LeMond aggressively shaped the carbon tubes, minimizing surface area where possible, and also introduced high-modulus carbon throughout the frame. The end result is a built-bike weight of 15.1 pounds on a 55 cm bike without pedals. The advertised retail price of the bike is $6699.99. www.lemondbikes.com

Snow scooter hood resists impact at low temperatures

Bombardier-Nordtrac OY, of Rovaniemi, Finland, has equipped its new snow scooter with hoods made of the glass fiber-reinforced polyurethane Bayflex solid, says Bayer Materials Science, Pittsburgh, Pa. This material was chosen for its high impact strength at low temperatures and the short cycle times, which allow particularly economical production of these comparatively large hoods. Plastics functioning at low temperatures obviously need exceptional mechanical properties – some materials soon become brittle at sub-zero temperatures.

The snow scooter hood is built to withstand daily wear and tear in open country: the Bayflex solid molding, which is about 1.10 meters long, one meter wide, and 0.4 meters high, has exceptional impact strength over a temperature range of –40 to +80°C and very good inherent rigidity because of its glass fiber content of 20%.


Composite bike frame has low weight, high strength

This bicycle has a frame made with IsoTruss, a composite structure invented by Prof. David Jensen of Brigham Young University, Provo, Utah. The highly symmetric and redundant nature of IsoTruss structures provides an attractive, efficient, and damage-tolerant design. The open grid enables a variety of standard and innovative connections.

IsoTruss achieves its high strength-to-weight ratio with a special geometry composed of longitudinal and helically wound members. The “iso” and “truss” in IsoTruss come from its efficient
The combination of motorcycle technology and precision steering provides the T-Rex with optimal handling. The 28 liter fuel tank supplies a 1200 cc, 4 cylinder engine that gives the T-Rex excellent acceleration.


**Polycarbonate helmet has low-temperature impact strength**

The production of protective motorcycling helmets by the Nolan Group of companies began in the early 1970s, when it was decided that GE Plastics Lexan polycarbonate resin, the same material used by NASA for astronaut helmets, would further improve motorcycle helmet safety. Nolan chose the co-polymer polycarbonatesiloxane Lexan EXL resin for the shell of its full-face, flip-up helmet model. The specific grade chosen offers excellent impact resistance at low temperatures, superior chemical resistance, and enhanced paintability. Together with the protective shell, another key element of a motorcycle helmet is the visor. Lexan optical quality polycarbonate resin enables optical clarity with enhanced eye protection against UV rays.

For more information: Christopher Tessier, GE Plastics, Pittsfield, MA 01201; tel: 413/448-6926; christopher.tessier@ge.com; www.geplastics.com, www.nolan.it.

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geometry; isosceles triangles that form a truss of pyramids. The structure incorporates stable geometric forms with members that spiral in a piece-wise linear fashion in opposing directions around a central cavity. The helical and longitudinal members are repeatedly interwoven, yielding a highly redundant and stable configuration.

For more information: David Jensen, Brigham Young University, Provo, UT 84602; jensen@ee.byu.edu; www.isotruss.org.

**Three-wheel motorcycle handles like sports car**

Despite being classified as a motorcycle, the radically styled T-Rex three-wheeler handles more like a sports car with the help of huge, sophisticated rear suspension that significantly enhances road holding. The chassis features a multi-tubular steel-roll cage for maximum protection and the glass-fiber reinforced plastic body contains a carbon-fiber windshield and headrest.