

Nanotechnology - Does It Have a Sporting Chance?*

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It's been hard to miss the hype that's surrounded nanotechnology the past few years. On one side, industrialists and academics hype nanotechnology's wide-ranging potential applications, hoping to garner government funding. On the other side, advocacy groups agitate about the potential dangers of exposure to nanoparticles, working to stir up public awareness—and gain membership fees, to boot. As usual, the truth about nanotechnology lies somewhere in-between the two sides' positions, but it is important that the debate does not go the same way as the dispute over genetically modified foods.

Nanotechnology is debated as though it was a new technology, but it's not. Our own bones are composed of self-assembling nanostructures. Car tyres have included carbon black nanoparticles for decades. The red and yellow colours in sunsets are caused by nanoparticulate pollution (both volcanic and from chimneys) and many food products are nanoemulsions or particulates. Scanning tunnelling microscopy enabled us to observe objects at the nano-scale, revealing that at that level, thermal, optical, mechanical, electronic, magnetic, and surface properties change. This realization has driven the search for new products, and the sporting goods industry has lead the way.

From Bowling Balls to Tennis Balls

For example, bowling balls are usually covered in scratches; hardly surprising when they hit the pins at the end of the alley with such force. One enterprising company used nanoparticulate coatings to give the balls a scratch-resistant surface, enabling them to look pristine for months. A similar technology is being used for the final lacquer coating on a number of Mercedes vehicles, and the results have been impressive.

Wilson Sporting Goods recently introduced a nanocomposite tennis racquet, currently used by Switzerland's Roger Federer. Use of the racquet has enabled Federer to consistently hit the ball harder. Wilson also offers a new *Double Core* tennis ball that keeps its pressure longer, even when Federer and others hit it in excess of 150 mph. The new balls have a butyl rubber nanocomposite coating inside that acts as a barrier, preventing air from getting out. This same technology is also being used for footballs and for food packing, helping slow degradation by preventing flavor from getting out of the packaging and oxygen and ultraviolet light from getting in.

Golf Clubs, Fly Rods, and Racing Bikes

Nanocomposite materials are also being used in fly-fishing rods from Redington; the rods' nano-titanium resin layer gives them a lighter weight and stronger frame

than has previously been possible. Nanocomposite golf balls are on the market, and Wilson is leading the way with Nanotech golf clubs. These new drivers and fairway woods have a nanocomposite material that reduces the weight of the crown of the club, lowering the center of gravity and giving longer and straighter drives. These clubs also have carbon nanotubes in the tip section of the shaft to improve stability and add to the length of the shot. Pdraig Harrington, Ireland's leading golfer, attributes his recent success to the new clubs. His caddy is grateful for nanotechnology as well; Harrington's golf bag is made from a new nanofabric that has reduced the weight of the bag by 52%.



Nanotechnology has also made inroads in the textile industry. Stain-resistant clothing has been available for the past few years, and a new fabric has been designed specifically to repel grass stains and help *whites stay whiter*—an advance sure to be welcomed by cricketers around the world. Socks are available that are based on the antimicrobial properties that silver nanoparticles impart. And many sunscreens now on the market contain nanoparticulate titanium dioxide, which blocks so-called “bad” ultraviolet rays while letting tan-giving rays through. Surfers and other athletes who cover their lips and noses with sunscreen will appreciate the distinction.

BMC, the leading Swiss bicycle brand, has developed a revolutionary bike for the number-one Pro Tour Team Phonak for the latest Tour de France. The company's enhanced resin system contains carbon nanotubes and exploits the fact that nanotubes have a strength-to-weight ratio a hundred times better than that of aluminium, and far

better than that of normal carbon fibers. The combination of good riders and excellent bikes has put Team Phonak at the top of the worldwide UCI ProTour ranking.

In the Cold and in the Shower

Winter sports are also benefiting from nanotechnology, with nanofibers being used to windproof and waterproof ski jackets. And skis and snowboards themselves are being coated with a high-performance nanowax that produces a hard, fast gliding surface.

Micro-electromechanical systems (MEMS) — small, integrated devices that combine electrical and mechanical components — are commonplace nowadays, and top range cars often contain 50 to 100 sensors. As the trend from micro to nano continues, the sports industry will see increasing use of sensors in sports goods. Suunto markets a wide range of sensor-packed, wrist-top computers. One of their golf models has GPS incorporated into it and can indicate which club to use to reach the pin and avoid water and bunkers. Who needs a caddy — especially because the golf bags are so lightweight?



The author in action.

The use of nanotechnology in Formula One motor racing has not been widely discussed, but lighter-weight materials and nanosensors offer an advantage that will likely be seized upon. To the extent that the race depends heavily on the type of tyres used, there is a good chance that manufacturers such as Bridgestone and Michelin are investigating replacing their carbon black nanoparticle tyres with better-wearing and lighter nanocomposite products.

Even the changing rooms at the gym will be using more and more nanotechnology, as easy-to-clean and antimicrobial products become more prevalent. Nanocoated glass surfaces are already available for showers that prevent water droplets from sticking to the glass, keeping the surfaces cleaner longer. Samsung is using this technology to keep refrigerators fresher, and black mold in showers will become a thing of the past as tile and sealant manufacturers adopt this development.

A Trillion-Dollar Market

Markets of between one-half to one trillion dollars for nanotechnology are being forecast in 10 years time, so even a 1% share of the market will add more than \$5 billion to a country's economy. MEMS sensors and nanomaterials are predicted to reach \$100 million in 2009 for the sporting goods market. High-tech sporting goods are leading the way for nanotechnology, but other industry sectors are quickly jumping on board. If concerns about exposure to nanoparticles continue to be addressed successfully at an international level, all industries utilizing nanotechnology will have a sporting chance of success.

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