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Future Body Armor: Is Nanotech Ballistic Fiber the Next Step in Soft Body Armor?

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If DefenseReview is to believe what it's been reading over the last few weeks in the "mainstream press", body armor and other types of ballistic armor (vehicle armor and bomb-resistant panels, for instance) utilizing carbon nanotubes (CNTs) may be upon us, soon. We'll see. What we do know is that two separate groups in the world of academia have been working to make this happen.

First up is a rather ambitious British team, consisting of Dr. Alan Windle, Dr. Marcello Matta, Dr. Anna Moisalam and PhD student Juan Vilatela, (and most likely a number of others) out of the Department of Materials Science and Metallurgy at the University of Cambridge. They've been busy developing a "simple and ingenious" process by which ethanol...

is turned into something called "elastic smoke". "It makes particles of carbon that are like smoke. But because the carbon nanotubes are entangled, the smoke we make is elastic," Windle says. The nanotubes are stretched and turned into a very strong, lightweight and elastic ballistic-grade carbon nanotube material that is said to resemble an "ever-expanding dark sock" that stretches to the point that it can be wound up on a reel. Chemically, what's going on is the ethanol, a "hydrocarbon feedstock", is broken down into hydrogen and carbon using an iron-based catalyst. The carbon particles are chemically "re-built" on the iron catalyst to create the long, thin-walled carbon nanotubes.

The "elastic smoke" fiber can also supposedly be woven easily into a fabric.

According to Professor Windle, the resulting CNT fiber (Carbon NanoTube fiber) is "up there with the existing high performance fibers such as Kevlar", and adds, "We've seen bits that are much better than Kevlar in all respects. But this is a laboratory-scale fiber, and laboratory-scale fiber will always have good bits and bad bits because you have to work to get the defects out.."

Dr. Windle's goal is to industrialize the nanofiber (a.k.a. nano-fiber)-making process. Cambridge Enterprise Limited, The University of Cambridge's commercialization office, filed for patent on the process/technology in 2003, and has licensed it spin-out company Q-Flo Limited.

Second up is the Australian team of Professor Liangchi Zhang and Dr. Kausala Mylvaganam out of the Centre for Advanced Materials Technology, University of Sydney. Not to be outdone byt the first group, these two gentlemen appear to be interested in fashioning sheets of carbon nanotubes, and reportedly claim

that a .6mm-thick sheet of the material (carbon nanotubes) can stop a bullet with 320 joules of energy behind it, whatever that means. Not that much energy, but at least it's a start. More joules means you need more layers to stop it. Anyway, they even wrote a paper on it.

Ballistic resistance capacity of carbon nanotubes (PDF Format)

The goal of both teams' endeavors, of course, is to create the strongest man-made fiber in existance. Again, we'll see. While the viability of both teams' respective solutions remains uncertain, Defense Review is convinced that nanotechnology represents the future of ballistic armor development of all types, including body armor, vehicular armor, and structural armor. Nanotechnology, at present, would appear to be the most viable means of enhancing the capability (i.e. strength to weight ratio) of ballistic fiber armor (i.e. soft armor), ceramic armor, and even polymer armor.

Defense Review would specifically like to see the development of extremely lightweight nanotech polymer armor (ballistic armor a.k.a. bullet-resistant armor) that can handle armor-piercing (AP) rifle rounds. Advanced anti-rifle polymer armor would most likely solve the problems that currently plague ceramic composite armor, like 1) high cost and susceptability to rapid and drastic price change, 2) difficulty in producing it in quantity, 3) brittleness (especially with boron carbide), and 4) excessive weight.

While the jury's still out on the efficacy of the new nano-armor material, we wish the above academics luck, and we'll keep an eye on their work.

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