Spider Silk

Biomimetic Principle

Kevlar is one of the toughest materials humans can produce. But it is very demanding to produce: it involves heating oil to over 700°C, and then dragging out long, thin fibres under enormous pressure in vats filled with sulphuric acid. Once made, though, it will last centuries in a landfill.
But spiders do it differently:
Spiders have learned to produce fibres with the "right" balance of properties for whatever application they choose (tough for the outer silk of the egg sac, soft for the inner layer of the egg sac, sticky for joints and attachments, etc.) And the production process is rather less dramatic. The silk is produced in the abdomen of the spider, at room temperature and normal pressure, using flies and crickets as the main raw material. There is no toxic waste and the silk is entirely biodegradable.

Spider silk is

- Almost as strong as high tensile steel wires of the same thickness
- 6x stronger than steel weight for weight
- 8x more extensible than Kevlar
- 5x tougher than Kevlar
- Biocompatible
- Biodegradable
- And is chemically decorated for function.

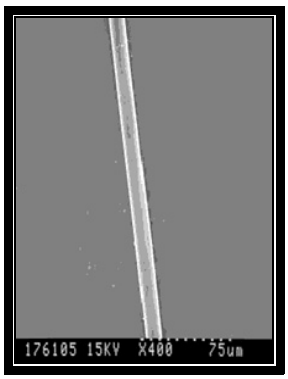
Further Information:
Papers: Fritz Vollrath and David P. Knight, "Liquid Crystalline Spinning of Spider Silk", Nature Vol 410, pp. 541-548, 29 March 2001

Websites:
http://www.arachnology.org/Arachnology/Pages/Silk.html

Applications

- Novel biomaterials and biocomposites for medical applications
- High performance technical fibres and composites for industrial applications
- Military applications such as light, tough body armour, parachute wires
- Tennis racket strings, tough fabrics, biodegradable fishing lines

Current Commercial Development



Spinox

- For the past 15 years a small number of research groups have tried to understand how silk fibres are made. They mostly concentrated on the underlying chemistry, but Spinox also looked at the "processing" route:
- A Paradigm Shift in Spinning, a combination of biology, physics and chemistry of spider silks, with nano-engineering, micro-fluidics, integrated sensor and actuator technology
- *What do Spinox fibres look like*?
  From electron micrographs we can see that they are uniform in cross-section – they are about 15µm in diameter – and have a very smooth surface

Website: http://www.new-greenham-park.co.uk/news.htm#100303

Nexia

- Nexia scientists have put spider genes in mammal cells to make their version of spider silk. The company now has genetically modified goats that will produce the protein in their milk.
- Nexia researchers now want to make larger quantities of their silk from a herd of goats carrying the spider genes. These genetically modified animals were bred from a pair that made their first public appearance in August 2000.

Website: http://www.nexiabiotech.com/en/01_tech/01.php