While at the 2005 AAOS Annual Meeting February 23-25,

devices incorporating Dyneema Purity can be found at:

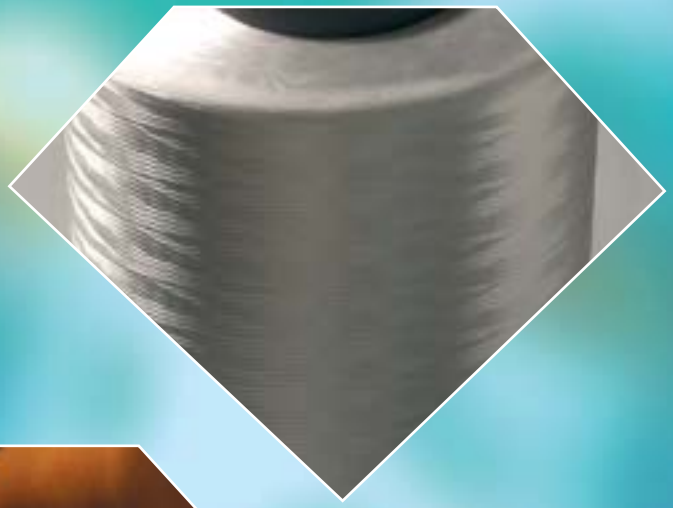
ConMed Linvatec (booth 1003)
DePuy Mitek, Inc. (booth 3406)
Biomet, Inc. (booth 3609)
Teleflex Medical OEM (booth 3803)

WITH Dyneema® Purity

Dyneema® Purity

World-leading strength for surgical implants.

a DSM Brand



The world's strongest fiber

Dyneema Purity stands for a specially developed, high-performance polyethylene fiber technology from DSM Dyneema, which is made available to the medical device industry. Dyneema® fibers are the strongest in the world: weight for weight 15 times stronger than steel (typical cable steel). These fibers are made from Ultra High Molecular Weight Polyethylene (UHMWPE), a material that is well known within the orthopaedic community. Combined with other benefits like its high level of stiffness, fatigue resistance and abrasion resistance, Dyneema Purity offers an exciting new material for consideration when designing improved or completely new devices.

High strength – making things stronger or smaller

Since size is an important factor in the design of medical implants, Dyneema Purity provides a solution. When Dyneema Purity fibers are braided into a suture, the resulting suture is approximately half the thickness of a polyester product with the same strength. In fact, if Dyneema Purity fibers were braided into a thicker cable for more demanding applications, the cable would have approximately the same thickness as an equally strong steel cable, yet at the same time be significantly lighter and more flexible due to its polymeric nature.

More gentle than metal

Metal cables also have certain disadvantages. The products are inflexible and have sharp edges when cut, risking to hurt patients and surgeons alike. Metals can also fail if twisted or bent due to their fatigue properties. Dyneema Purity fibers are unique in their gentleness being not only much more flexible, but also smooth. In addition, the fatigue resistance is excellent. In fact, polyethylene cables tested under representative conditions have shown a far greater (>100 times) 'flex-life' (resistance to fatigue) than steel and titanium. Consequently, the risk of fracture during and after the operation is greatly reduced, and Dyneema Purity fibers will not easily break or lose their strength when bent, twisted or stretched.

The high strength of Dyneema Purity fibers can be used to improve devices in two ways. Using a stronger material results in stronger constructions. On the other hand, devices can be redesigned to deliver the same strength in smaller dimensions.

is also the most gentle.

Already in Use

Dyneema Purity fibers can already be found in products developed by some of the world's leading medical device companies.

WITH Dyneema® Purity

When searching for new devices made with the world's strongest fiber, look for the Dyneema Purity ingredient logo.

Orthopaedic sutures: Stronger and thinner.

Each year, millions of people visit their doctors due to shoulder pain. About one quarter of these patients will seek a specialist's care for rotator cuff tears or related injuries. Strong, thin, pliable sutures are needed for arthroscopic and open repairs of ligaments and tendons. Knot strength is an important characteristic. Knots that fail after surgery can lead to additional procedures, higher costs and unnecessary discomfort for patients.

That's why manufacturers increasingly are choosing Dyneema Purity fibers as the raw material for their sutures. These new and improved sutures distinguish themselves from common polyester sutures in both tensile and knot strength. A 100% Dyneema Purity braid offers the strength of similar polyester products at half the thickness. Knots made during suturing are therefore significantly smaller yet strong. Typically, #2 sutures made with Dyneema Purity fibers are comparable in tensile strength to #5 sutures made from polyester.

In addition, Dyneema Purity fibers are smooth. As a result, sutures made with Dyneema Purity slide more easily through both tissue and suture anchors during arthroscopic surgery. Furthermore, the abrasion resistance of the UHMWPE offers higher resistance to fraying, thus reducing the risk of breakage during procedures.

ACL:
Typical tensile strength of human ligaments and tendons is about 50 – 105 MPa

Hair:
Typical tensile strength of human hair is 190 MPa

Dyneema Purity:
Typical tensile strength of a Dyneema Purity fiber is 3000 MPa

Bone:
Typical tensile strength of human long bones is 120 – 150 MPa

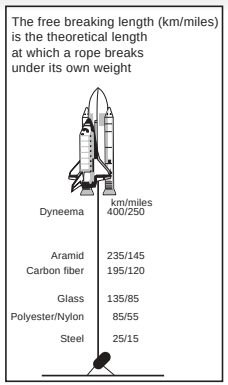
Spider's silk:
Typical tensile strength of Spider's silk is 1400 MPa

Performance through power

The human body is amazing, with bones and joints capable of bearing considerable weights. But sometimes bones and joints fail, and that's when Dyneema Purity is able to help deliver a suitable repair.

Compare the tensile strength of Dyneema Purity fibers to human and natural materials (see above). The values indicate a strength per volume – illustrating how Dyneema Purity can be used to make devices that are strong, yet small.

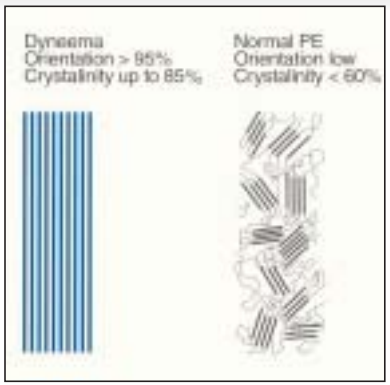
To give an example: a braid of Dyneema Purity with a diameter of 1 mm is capable of carrying the weight of an average (app 90 kg) adult male.



The Dyneema story – inventing the gel spinning process

The gel spinning process as it has been developed by DSM is unique in that it uses a solvent to turn the very tough polymer UHMWPE into a gel-like substance, which can subsequently be spun. In this process the molecules are "dissolved" in a solvent and spun through a spinneret.

The effect of the solvent is that within the gel or solution, the molecules that originally formed strong clusters in the solid state now become disentangled. Furthermore, they remain in this disentangled state after spinning when the gel is cooled to give filaments. As the fiber is drawn, a very high level of macromolecular orientation is obtained (see Figure). This parallel



orientation of the molecules is more than 95%. This is the reason for Dyneema's exceptional strength, and it also results in a very high crystallinity of approximately 85%.

Despite the unique tenacity (strength per weight) and modulus (stiffness) in the axial direction of the fiber, in the cross-wise direction the fibers behave more or less like normal polyethylene, thus maintaining a very high flexibility. Furthermore, the typical raw material UHMWPE still retains its properties of high abrasion resistance, toughness and flex-fatigue, all of which have been maintained in the fiber. Thanks to the raw material, the fiber is inert to most chemical solvents such as acids and bases and does not absorb water.

Since being launched in the late 80's, Dyneema fibers have penetrated a wide variety of high-tech markets worldwide. They have been successfully applied in bullet-resistant products (vests and panels, including those used in the doors of airplane cockpits), ropes, fishing nets, cut-resistant gloves, sails, sailing ropes and fishing lines.

DSM Dyneema is focused to remain the leading innovator in the field of high performance polyethylene fibers. One of the most recent innovations is the special development of Dyneema Purity fibers, which are offered to medical device companies. Some typical values for the Dyneema Purity product, the SG fiber grade, are given in Table 1.

Table 1: Typical product data SG fiber

Property	Unit	Value
Density	g/cm3	0.97
Average Molecular		
Weight (Mw)	g/mol	App. 2,5 M
Strength		
Tenacity	N/tex	3.2
Tenacity	g/den	36
Tensile Strength	GPa	3.1
Modulus		
Specific Modulus	N/tex	101
Specific Modulus	g/den	1144
Modulus	GPa	98
Elongation at break	%	3.4

Innovation in products and applications
Innovations from DSM Dyneema originate from the globally renowned fiber laboratory of the company. This well-equipped competence center is dedicated to the development and application of polyethylene fibers. It is the high degree of specialized knowledge available within this laboratory that have made Dyneema fibers so strong, and their applications so versatile.

This laboratory has been the basis for numerous developments that enable the fiber to be shaped into any kind of textile, including braids (for sutures and cables), and woven and knitted fabrics. DSM Dyneema is always searching for opportunities to combine its knowledge and expertise with that of medical (industry) partners in order to co-create tailor-made solutions for existing problems and unsolved medical needs.

A new spinning process in a controlled environment
Dyneema Purity fibers have been developed with a specific view to obtaining the highest level of quality and purity. The fiber is therefore produced using a pioneering new spinning process (patent pending). The process is tightly controlled in order to meet the highest specifications with respect to both mechanical properties and chemical composition. For improved processability the fiber is standard twisted. Although an ingredient only, Dyneema Purity fibers themselves have been tested by an independent laboratory for cytotoxicity (ISO 10993-5), sensitization (Delayed type hypersensitivity, ISO 10993-10/2002), irritation (ISO 10993-10/2002), and mutagenicity (Reverse mutation assay, ISO 10993-3/1992). While developing the process DSM Dyneema benefited from expertise in other areas of the DSM company, which is not only focused on performance materials like Dyneema, but has a strong position in various life science markets as well.

The unlimited world of DSM
DSM is an advanced biotechnology, materials and chemicals company listed on the stock exchange and with manufacturing sites and sales offices across the globe. In the century of its existence it has evolved to this position from its start in coal mining with vision, a willingness to

A new blueprint for innovation and patient comfort

embrace change, and a strong capacity for innovation. DSM is a highly valued supplier to virtually every major global producer in the pharmaceutical, food and feed ingredients, performance materials, industrial chemicals and agrochemicals industries.

Today the company is the largest supplier to the life sciences industry globally. More specifically, DSM is the world's leading supplier to the pharmaceutical industry, with seven of the world's 20 top selling drugs containing DSM products. It is also one of the largest suppliers of advanced ingredients for the food industry.
For example, DSM supplies cheese ingredients, ingredients for flavourings and flavour enhancers, bakery ingredients (e.g. yeast), and also specific ingredients for baby food and other functional food-supplements.

Furthermore DSM is the leading supplier of vitamins and carotenoids for food and feed applications and offers its customers in cosmetics industries a portfolio of vitamins, bioactive ingredients and UV filters. Besides its extended activities in various forms of life sciences, DSM also ranks among the global top five with many of its performance materials and is the global leader in a number of industrial chemicals.

As such, DSM is uniquely positioned to create new materials for the medical device industry. With unique expertise on both performance materials and life science businesses put together, all elements are available to create innovative, reliable products for almost any industry.

Dyneema Purity fibers can be seen as the logical fusion of life sciences and performance materials that DSM embodies.

Dyneema® Purity

The description by DSM Dyneema of the characteristics and properties of its products as contained in this brochure is supported by research and believed to be reliable. It is for general information purposes only, and may not be relied upon in individual situations. Dyneema Purity fibers are supplied under contract containing detailed product specifications, and the user shall be exclusively responsible to assess the suitability of the product as specified for any individual application or use.

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a DSM Brand