Toyobo-DSM to Market Superfiber

Toyobo Co., a major Japanese fiber and textile manufacturer, has set up a joint company with the state-owned N.V. DSM of the Netherlands to develop and market a new superfiber. The joint company, called Dyneema V.O.F., was founded in May 1986, with 51% owned by DSM and 49% owned by Toyobo, to pool DSM's patented technology for the production of superstrong polyethylene fiber and Toyobo's production and processing technology for the marketing end.

Dyneema is building a pilot plant at Otsu, Shiga Prefecture, in western Japan, and delivery of new fiber samples produced at the plant is planned for later this year. If the test production and marketing programs go well, Dyneema will start construction of a commercial fiber production facility in the Netherlands in 1988.

The new fiber is called Dyneema SK-60 and is a superstrong polyethylene fiber. This high-performance fiber has many features lacking in Du Pont's Kevlar 49, which has dominated the world's high-performance fiber market since its introduction nearly 20 years ago. Dyneema SK-60 is more highly resistant to chemicals, ultraviolet rays and abrasion than other superfibers. Its tensile strength is 35–50 g/denier, far above Kevlar's 22 g/denier, and its modulus of elasticity is 900–1,400 g/denier, also well above Kevlar's 1,080 g/denier; it is also highly impact resistant although relatively vulnerable to heat.

Because of its light weight and superior strength, Dyneema SK-60 can be used for more varied applications than existing superfibers. At present it is considered a promising material for rope used in ocean development projects; application in sporting goods such as tennis racquets and baseball helmets is anticipated; and it is being considered as material for the manufacture of bulletproof vests and audio instruments.

Teijin Limited, Sumitomo Chemical Co. and other Japanese firms are all conducting research on development of high-performance fibers or are preparing to market them shortly. With such competition, the superfiber market promises to expand rapidly in the years ahead. (Tsukasa Fukuma, staff writer with Kyodo News Service)

The new high-performance fiber Dyneema SK-60, made of superstrong polyethylene, has several advantages over Du Pont's market-dominating Kevlar 49.

New Ultrathin Membranes Made from PDiPF

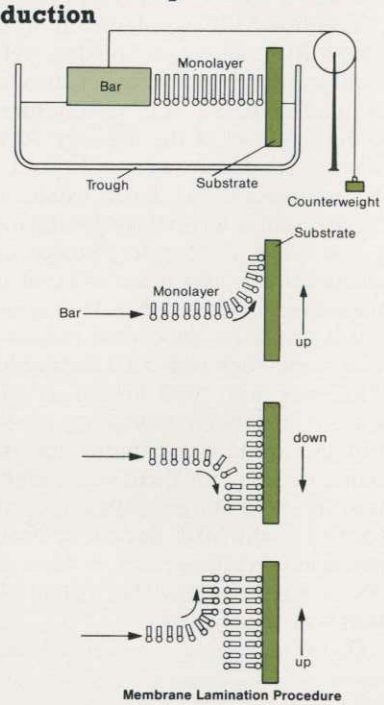
A research team composed of Senior Researcher Akira Yamada and Kiyotaka Shigehara of the government Institute of Physical and Chemical Research in Wako, Saitama Prefecture, Senior Researcher Yoshishige Murata of the Tsukuba Research Laboratory of the Nippon Oil and Fats Co. and Professor Seizo Miyata of the Tokyo University of Agriculture and Technology has developed a new ultrathin membrane made from poly[di(isopropyl) fumarate] (PDiPF) to be used as an organic insulator in next-generation high-speed computers. Their achievement was reported at the June 1986 annual meeting of the Polymer Society of Japan in Kyoto.

Josephson-junction devices and superlattice devices are now being developed for the fifth generation of computers, both based on the working principle of the tunnel effect and requiring ultrathin membranes for their manufacture. The tunnel effect is a quantum-mechanical phenomenon referring to the ability of a particle to pass through a finite region in which the particle's potential energy becomes greater than its total energy. The membranes used in the production of Josephson-junction or superlattice devices must be 2 millionths of a millimeter or less in thickness, with sufficient mechanical strength and heat resistance.

Up until now, the Langmuir-Blodgett (LB) process has been used to produce ultrathin membranes. In this process, a polymer is dissolved in an organic solvent and added to water. The solvent and polymer then separate, and the solvent finally evaporates. The polymer molecules remain separate in the aqueous solution until horizontal pressure is applied to form them into an ultrathin membrane. A solid substrate is passed over the surface of the aqueous solution and the membrane attaches to the substrate. The conventional LB process does not always produce a perfect ultrathin membrane without pinholes or cracks, but the PDiPF polymer produces a nearly perfect membrane each time. These new membranes are only 0.85 millionths of a millimeter thick and resistant to external pressure and temperatures as high as 200°C.

Test results indicate the PDiPF ultrathin membrane is suitable for industrial use, especially after lamination, when the membranes become mechanically stronger and have greater heat resistance. The research team reported that laminated PDiPF membranes can be used in the production of such electronic components as light-emitting diodes, field-effect transistors and solar batteries. (Akira Shoji, staff writer with Kyodo News Service)

The Basic Principle of LB Film Production



Membrane Lamination Procedure