Manufacturing & Prototyping

Fabricating PFPE Membranes for Capillary Electrophoresis

Precisely sized and positioned holes are defined by photomasks.

NASA's Jet Propulsion Laboratory, Pasadena, California

A process has been developed for fabricating perfluoropolyether (PFPE) membranes that contain microscopic holes of precise sizes at precise locations. The membranes are to be incorporated into "laboratory-on-a-chip" microfluidic devices to be used in performing capillary electrophoresis.

The present process is a modified version of part of the process, described in the immediately preceding article, that includes a step in which a liquid PFPE layer is cured into solid (membrane) form by use of ultraviolet light. In the present process, one exploits the fact that by masking some locations to prevent exposure to ultraviolet light, one can prevent curing of the PFPE in those locations. The uncured PFPE can be washed away from those locations in the subsequent release and cleaning steps. Thus, holes are formed in the membrane in those locations.

The most straightforward way to implement the modification is to use, during the ultraviolet-curing step, an ultraviolet photomask similar to the photomasks used in fabricating microelectronic devices. In lieu of such a photomask, one could use a mask made of any patternable ultraviolet-absorbing material (for example, an ink or a photoresist).

This work was done by Michael C. Lee, Peter A. Willis, and Frank Greer of Caltech and Jason Rolland of Liquidia Technologies Inc. for NASA's Jet Propulsion Laboratory.

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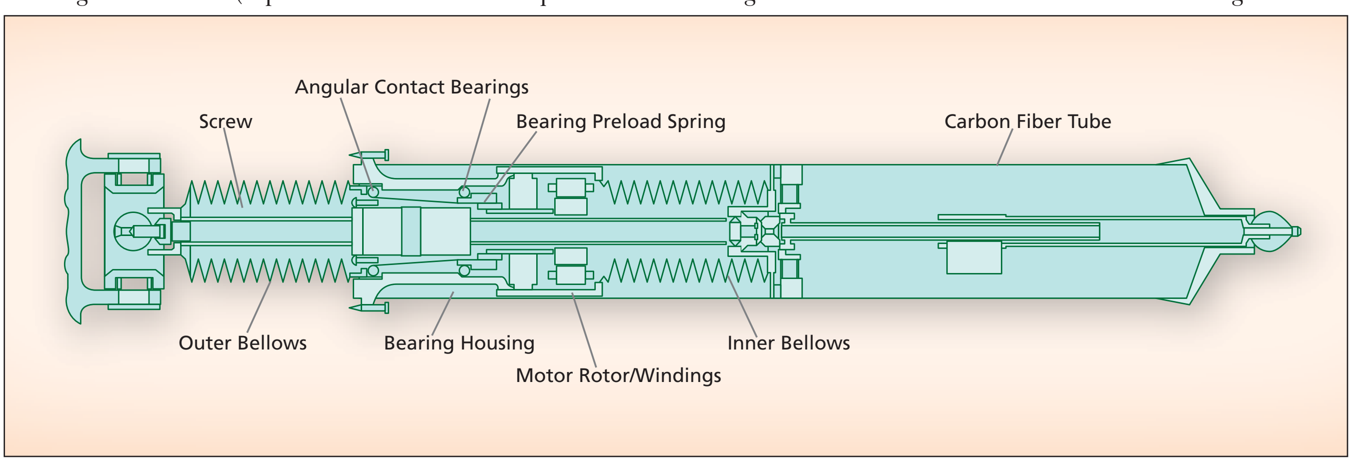
Linear Actuator Has Long Stroke and High Resolution

There are potential applications in precise measurement and precise fabrication.

NASA's Jet Propulsion Laboratory, Pasadena, California

The term "precision linear actuator, direct drive" ("PLADD") refers to a robust linear actuator designed to be capable of repeatedly performing, over a lifetime of the order of 5 to 10 years, positioning maneuvers that include, variously, submicron increments or slews of the order of a centimeter. The PLADD is capable of both long stroke (120 mm) and high resolution (repeatable increments of 20 nm). Unlike precise linear actuators of prior design, the PLADD contains no gears, levers, or hydraulic converters. The PLADD, now at the prototype stage of development, is intended for original use as a coarse-positioning actuator in a spaceborne interferometer. The PLADD could also be adapted to terrestrial applications in which there are requirements for long stroke and high resolution: potential applications include medical imaging and fabrication of semiconductor devices.

The PLADD (see figure) includes a commercially available ball-screw actuator driven directly by a commercially available three-phase brushless DC motor. The ball-screw actuator comprises a spring-preloaded ball nut on a ball screw that is restrained against rota-



This **Partly Schematic Cross Section** depicts some of the components of the PLADD.