Wet anisotropic etching of polyimide

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With the aim of developing flexible biocompatible implants for *in vivo* studies of nerve regeneration [1], fabrication of passive polyimide membranes using the commercial available Kapton film (100HN and 50HN, from DuPont) was investigated.

Polyimide has been widely used in microelectronics, and its application possibilities have been widening to other fields such as micromachining and biomedical products [2]. Nevertheless, this widespread utilization has not facilitated its processing. Etching options for obtaining anisotropic structures are restricted to RIE (reactive ion etch) and plasma etch [3]. Here we present a wet chemical method with the use of TEAH (tetraethylammonium-hydroxide) as alternative etchant to obtain polyimide membranes with the following processing sequence:

Negative resist was spun on both faces of previously dried polyimide foil (100HN and 50HN), including a baking done at 80°C between resist deposition. Subsequent baking has been done at 80°C for 20min. After development, post-baking has been done at 120°C for 15min. Samples were etched with TEAH (35%) at 40°, 50° and 60°C, with periods of time varying from 50 min (for 100HN at 40°C) to 10 min (for 50HN at 60°C).

No apparent difference has been noticed on the anisotropy of the samples, what means that it is independent from etching temperature. Fig. 1 shows an SEM (scanning electron microscopy) picture of a circumference seen from the back of the foil. One can notice the preservation of the mask definition even at the back (where no mask has been applied). Fig.2 shows an example of a square which has not been totally etched. One can observe the surface roughness where polyimide has been attacked (at the bottom of the structure), in opposition to the foil (previously covered) surface.

Fig. 1. A 450µm diameter circumference etched on a 13µm thick polyimide foil.

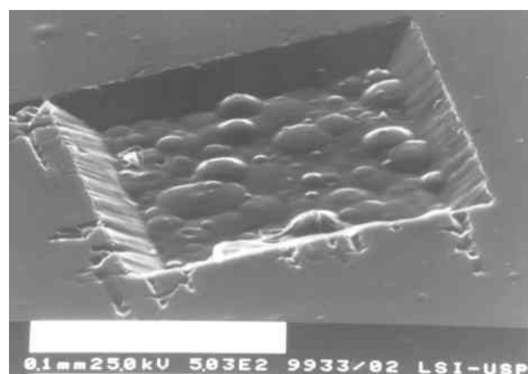

Fig. 2 - 150µm sided square, after 10 min etch in TEAH.

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[3] Richter, K., Orfert, M., Drescher, K., Anisotropic patterning of copper-laminated polyimide foils by plasma etching, **Surface and Coatings Technology**, vol. 97, p. 481-487, 1997.