Application of microsystem technology for medical implants (II)

The barrier coating for the implantable microelectrodes is essential for ensuring the reliability of the device and it is one of the most important components of the electrode structure. The most obvious function of the coating is protection of a fragile device against mechanical damage during the surgical insertion. However, in many applications, the coating should provide also a hermetic barrier against possible leakage of contamination from the electrode to the human body. It should also effectively protect the electronic circuit against humidity and corrosive biological effects. Silicone rubber, polyimide and parylene have been

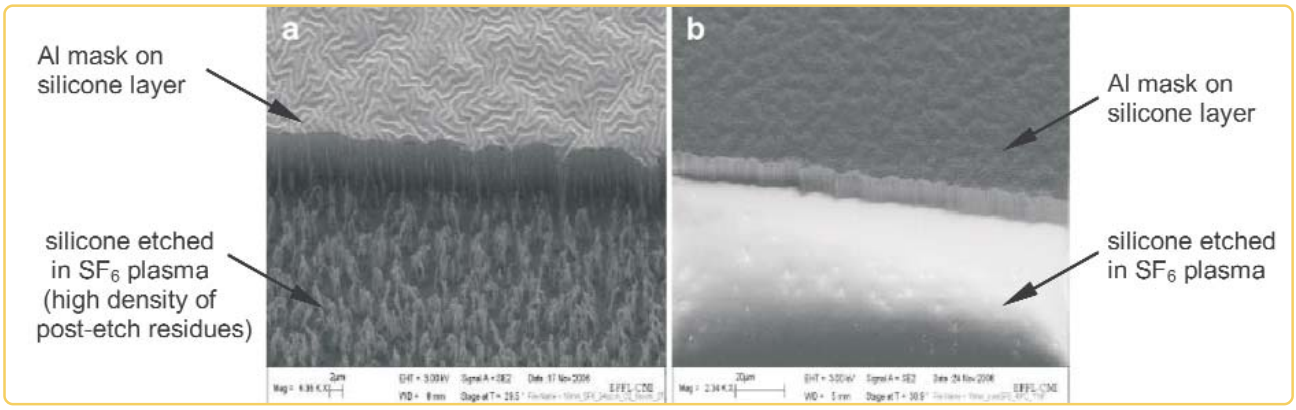

Fig. 3 SEM graphs showing the silicone morphology after exposure in SF6 plasma at 5 mTorr pressure, 800 W power, 100 V bias and substrate temperature of 20° C (a) or 40°C (b)

considered as the basic coating materials due to their biocompatibility and sufficient chemical stability. The hermeticity of parylene-silicone coating has been verified by electrical measurement of capacitive humidity detectors used in accelerated ageing tests. The comparative ageing test has shown a good seal performance against moisture and water ingress up to 72 hours immersion in hot salt water. It has been also found that structures coated with parylene and additional silicone structures protecting the edge of parylene had usually longer time to failure than structures with single parylene coating. Therefore, it has been suggested that the leakage observed during this experiment was related rather to the penetration of water below edges of parylene than to the migration of water through the parylene layer. The experiments have proven that silicone-parylene coating on the electrode manufactured in ITE had created a hermetic barrier, which could be sufficient for a short-term medical implants.

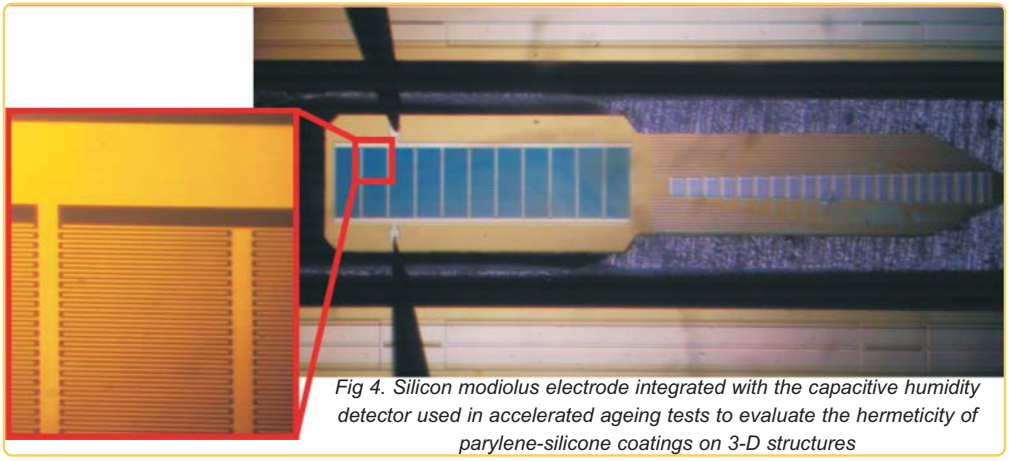

Fig 4. Silicon modiolus electrode integrated with the capacitive humidity detector used in accelerated ageing tests to evaluate the hermeticity of parylene-silicone coatings on 3-D structures

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Division of Silicon Microsystem and Nanostructure Technology (mInTE) located in Piaseczno near Warsaw, Poland, is a part of the Institute of Electron Technology (ITE).

The Institute is a major Polish R&D center with the primary focus on: **semiconductor electronics and technology**. **The mission** of the ITE is ***to conduct basic and applied research to develop and commercialize innovative micro- and nanotechnologies and their applications*** in the area of ***microelectronics, optoelectronics, photonics and microsystems***.

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