A bio-probe with integrated electrode array for *in-situ* chemical measurement

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Many organs, including the brain, use diffusible chemical agents to signal important information. Biosensors offer a very advantageous way of measuring these agents in real-time. Often several such signalling molecules may control a single process and their actions and/or production may be interdependent. It therefore becomes important to measure simultaneously several analytes in real-time, in a minimally invasive manner from a restricted and defined spatial domain.

Here is described a novel bio-probe for the real-time detection of different chemical agents within biological tissue. The micro-probe is fabricated using innovative silicon processing techniques combining deep reactive ion etching and physical powder blasting. These processes are employed to fabricate sensing probes either 4 mm or 8 mm in length, 30 µm thick and 140 to 550 µm in width, connected to a 2 mm × 2.5 mm base, as shown in Figure 1. The structure and shape provide both mechanical strength and easy insertion into biological tissue. On the top of the micro-probe is an array of individually addressable micro-band electrodes of Pt or Au between 5 and 20 µm in width with an opening of typically 0.5 to 1 mm, passivated by a thin layer of polyimide. A number of different electrode configurations have been fabricated with up to 8 micro-electrodes per probe. Each micro-band electrode is electrochemically coated with a different bio-sensing material allowing simultaneous and independent measurement of a range of chemical agents. The device should be of great value in the real-time monitoring of physiological signalling mechanisms.

By using these silicon processing techniques, it is possible to create large numbers of these micro-probes at low cost making them applicable for disposable applications. In addition, our techniques can be combined with standard CMOS processing to produce a sensor with integrated circuitry to improve the detection limit.

Keywords: bio-sensor, micro-probe, silicon

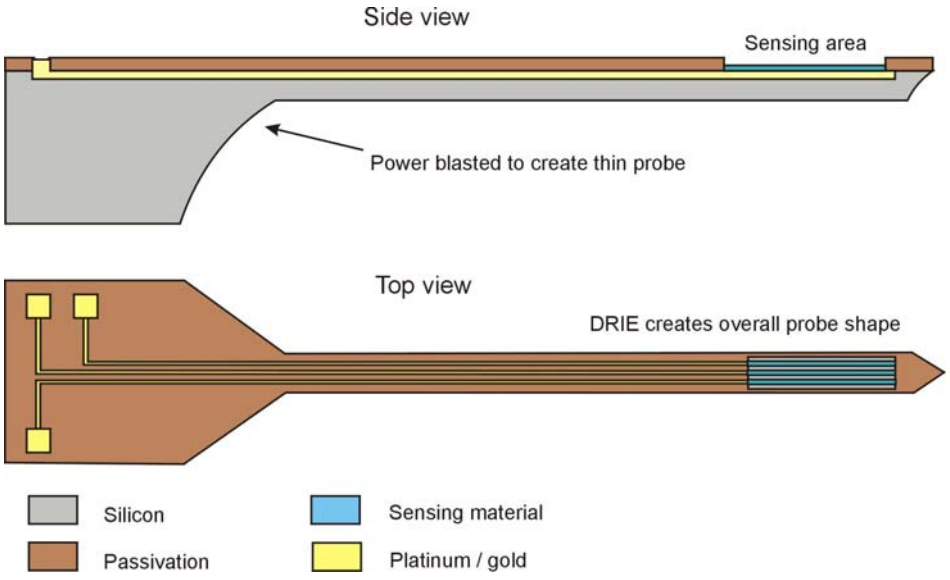

Figure 1: Overall schematic of bio-probe structure