Group 4-3

Fabrication of micro 3D sensor array with ultra-small Si wire electrode and applications to measurement of retina cell potentials

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Microelectrode Si probe array fabricated by VLS (Vapor-Liquid-Solid) growth on IC signal processing circuit has been proposed. This VLS-Si probe array can be fabricated on Si (111) wafers, and be used as electrodes for neural recording as well as stimulation. Figure 1 shows the image of sensor chip with penetrating high-density Si probe electrode array and on-chip signal processors.

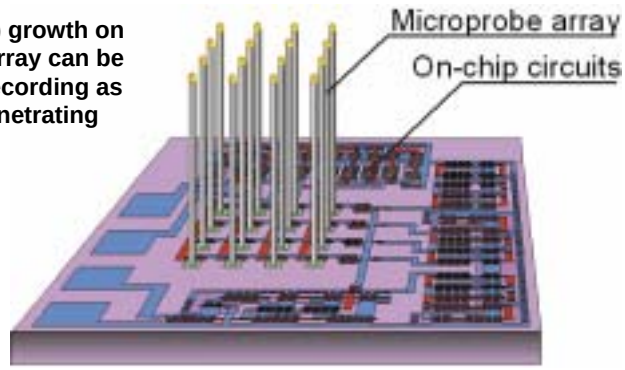


Fig.1 Multichannel micro-Si probe array chip for neural recording

Fabrication

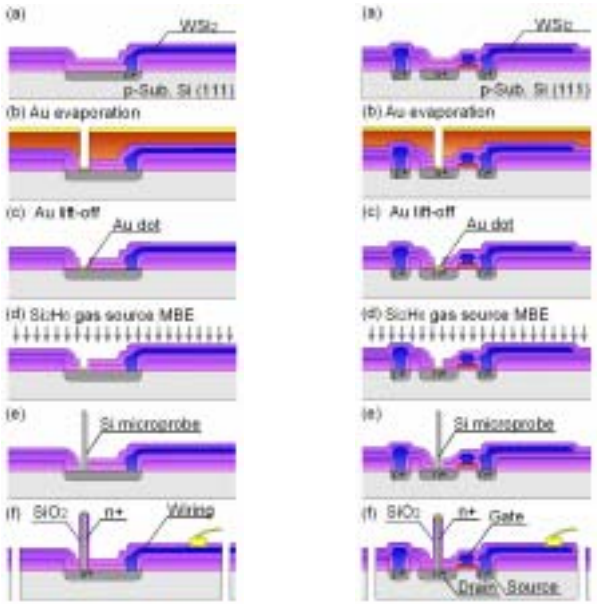


Fig. 1 Device process for Si probe with interconnection wirings and Si probe with on-chip MOSFET.

Microprobe Evaluations

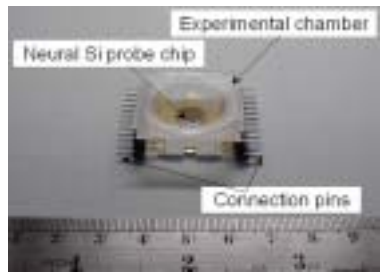
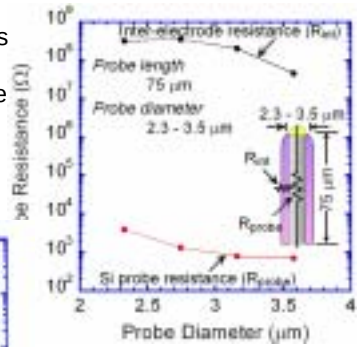


Fig. 3 Photograph of the packaged Si probe chip with fluid-tight chamber.

Fig.4 Resistance of the Si probes as a function of the probe diameters and the inter-electrode resistance of the encapsulating SiO_2 layer around the Si probes. Si probes length was 75 μm.



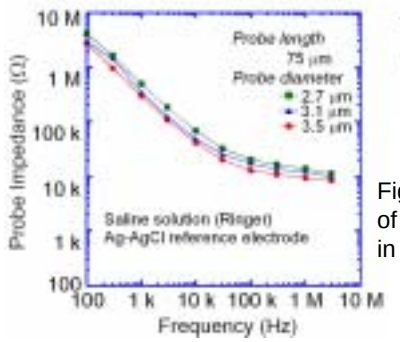


Fig. 5 Impedance spectrums of the Si probes 75 μm length in saline solution of ringer.

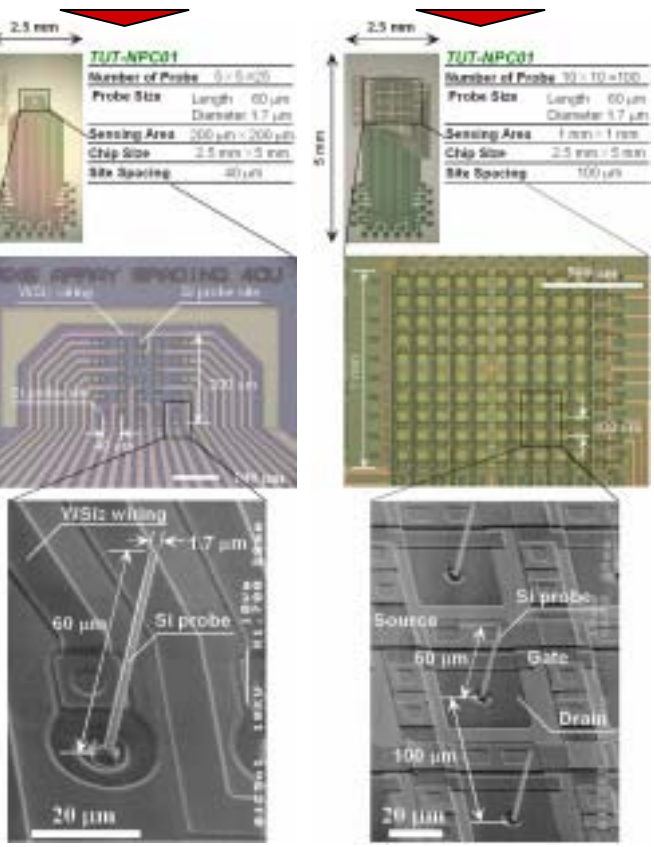


Fig. 2 Fabricated Si probe electrode array sensor chips of 5×5 array with wirings and 10×10 with on-chip site selection circuit.

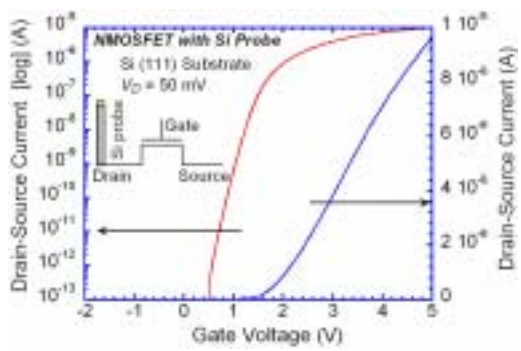


Fig. 6 Drain current I_D - gate voltage V_G curves of the on-chip NMOSFET for use in the site selection circuit.