New Electrode Technology for the Central and Peripheral Nervous Systems

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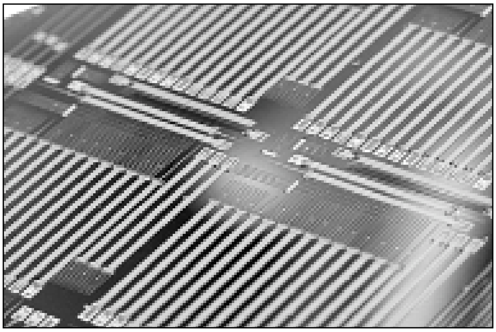
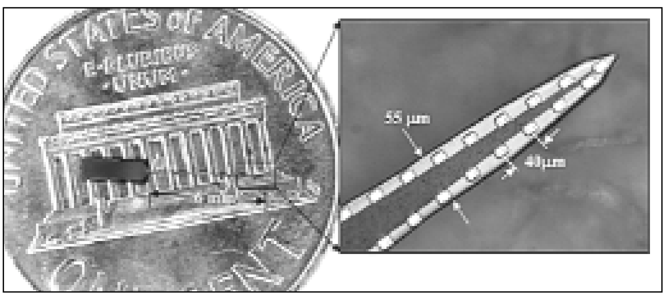
The goal of this project is to develop new devices, fabrication techniques, and materials for high-density neural probes that are smaller and more robust that ever before. Such devices are badly needed to improve our understanding of the brain (neuroscience) and for the realization of prostheses for disorders such as blindness, deafness, and paralysis. In the past, silicon ribbon cables formed using boron-diffused etch-stops have been used with silicon-substrate probes in chronic implants. But while thin boron-diffused silicon is very flexible and can be easily bent out-of-plane, it still breaks when bent too sharply. To overcome this problem, we have developed a process for integrating parylene cables with the probes at wafer level. Parylene is much more flexible than silicon and much less susceptible to fracture. Parylene cables lower the tethering forces on the implant and reduce associated tissue damage. Silicon probes with integrated parylene cables are still recording single units after nearly one-year *in-vivo*. We are also aggressively working to increase interconnect and recording-site densities on probes while shrinking probe size to minimize tissue damage. A single-shank, 32-site probe has been successfully fabricated for the first time using projection lithography to achieve submicron feature sizes and site densities more than twice those previously achieved. This project is supported by the Engineering Research Centers Program of the National Science Foundation under award number EEC-9986866.



Silicon probes with ultra-flex parylene cables, integrated at wafer level.



A new, single-shank, 32-site recording probe on the back of a U.S. penny.