Foundry Capabilities and Submission Guidelines

The PIE Foundry is established for the creation of polymer-based multi-electrode arrays (MEAs) for use in neuroscience research. The Foundry produces devices using small-batch micromachining and lithographic processing on biocompatible polymers. Within the following guidelines and limitations, devices of virtually any shape, size or design can be created. Broad capabilities include polymer deposition, metal deposition and patterning, anisotropic/isotropic plasma etching, thermal post-processing, and electronic packaging.

Custom Project Proposals:
PIE Foundry devices are built using 4" silicon carrier wafers, and as such the maximum span of any device (*excluding* connectors, wires and electrode interface boards) is approximately 3". Devices are fabricated on sets of 12-24 wafers, and the number of devices which can be produced is therefore inversely proportional to the size of each device.

Devices are built from micropatterned metal deposited on polymer sheets, and as such the basic shape of any device is a planar array. However, Parylene devices can be thermoformed into custom shapes as desired, and 3-dimensional designs including sheaths, cuffs and hemispheres have all been produced.

Parylene C polymer layers can be deposited conformally to a thickness between 0.5 and 20 μm in a single layer, with a precision of ± 0.3 μm. Pinhole free layers are only guaranteed at > 2 μm thickness. Other polymers may be used following request and discussion. Available metals for electronics or structural layers include Pt, Au, Cr, Al and Ti; other metals may be made available following request and discussion. Metals can be patterned to a minimum edge-to-edge feature size or spacing of 2 μm. For metal patterning on thin-polymer substrates we recommend evaporative deposition, which can be readily accomplished to thicknesses between 10 nm and 300 nm. Polymer micromachining can be accomplished with an alignment accuracy of ± 5 μm, and smallest free-standing etched features of 10 μm. Multi-layer processing is available.

For external electronic connections we offer connection to rigid or flexible PCB using zero-insertion force connectors, wire-bonding, or anisotropic conductive film. Common external connections including Omnetics brand connectors are available, or custom connectors can be used if compatible.

Foundry Services:
For users with prepared designs interested in free polymer Foundry services, designs must adhere to a common set of dimensions: 10 μm thick Parylene C encapsulating 200 nm thick Pt electrodes and traces. Designs may feature arbitrary geometry or electrode array design. A standard multi-project wafer run will include 20 4" diameter wafers with space shared among multiple users, and the number of devices which can be fabricated for each user will be limited by the size of the design.

Users should submit .gds, .dxf or gerberized files specifying a metal layer and cutout etches.

Testing Services:
For testing project proposals the PIE Foundry has the following metrology tools and expertise: X-ray photoelectron spectroscopy, electrochemical impedance spectroscopy, cyclic voltammetry, surface roughness measurement (AFM), optical and scanning electron microscopy, mechanical testing (fatigue failure, tensile strength, T-peel ASTM D1876-08), insulation failure (electrical cross-talk, water vapor permeation ASTM D1653-03) measurement, accelerated life-time testing. Additional or custom tests may be available following request and discussion.

Users may request testing of PIE Foundry devices or polymer MEAs constructed by themselves or other groups.