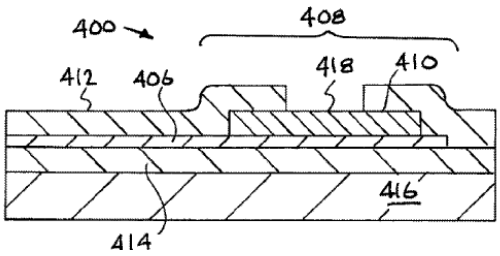
METHODS FOR FABRICATING AND IMPROVING UPON MICRO ELECTRODE ARRAYS

Background

The following portfolio offers many solutions to common challenges faced by researchers and manufactures who operate in the microelectrode fabrication space. Many of the disclosed inventions pertain to Microelectromechanical Systems (MEMS) and will find use in a wide variety of devices.

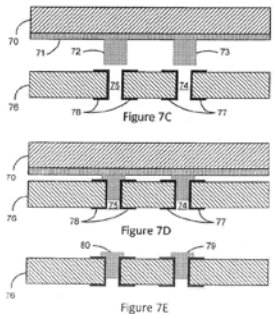
IL12387: DEPOSITING BULK OR MICRO-SCALE ELECTRONICS (US Patent 9,485,873 and US patent Application US2017/0013713)



This invention provides thicker electrodes on microelectronic devices using thermo-compression bonding. A thin-film electrical conducting layer forms electrical conduits and bulk depositing provides an electrode layer on the thin-film electrical conducting layer. An insulating polymer layer encapsulates a thin-film of electrically conducting layer and the electrode layer. Some of the insulating layer is removed to expose the electrode layer.

This technology is advantageous for long-term implantation of electrodes in animal or human subjects, as the thickness of the electrode dramatically increases the electrode's lifetime. This feature is important in medical and military sensor applications, where electrodes that can survive harsh environments for long periods of time are necessary.

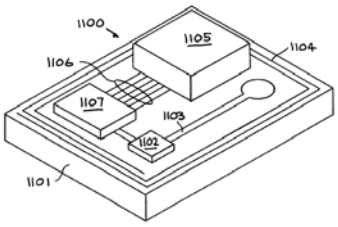
IL12468: METHOD OF FABRICATING ELECTRICAL FEEDTHROUGHS USING EXTRUDED METAL VIAS (US Patent Application US2015/0216051)



This technology encompasses a method of fabricating high-density, preferably bio-compatible, electrical feedthrough structures and interfaces. The method uses extrusion, forming electrically conductive vias for microelectronic applications.

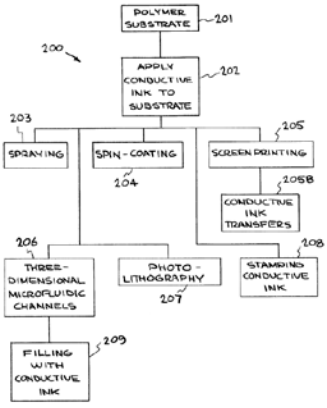
This technique is scalable, low cost, reduces pitch limitations, and reduces the chance of hermetic leakage. It also avoids damage induced by lasers and high temperature-dependent production.

IL11014: ELECTRONIC UNIT INTEGRATED INTO A FLEXIBLE POLYMER BODY (US Patent 7,342,311)



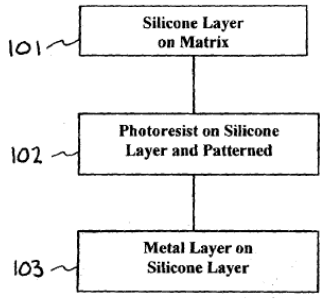
This invention describes a peel and stick electronic system comprises a silicon body, and one or more electronic unit operatively connected to the silicon body. The electronic system is produced by providing a silicon layer on a substrate, providing a metal layer on the silicon layer, and providing at least one electronic unit connected to the metal layer.

IL11037: CONDUCTIVE INKS FOR METALIZATION IN INTEGRATED POLYMER MICROSYSTEMS (US Patent 8,202,566)



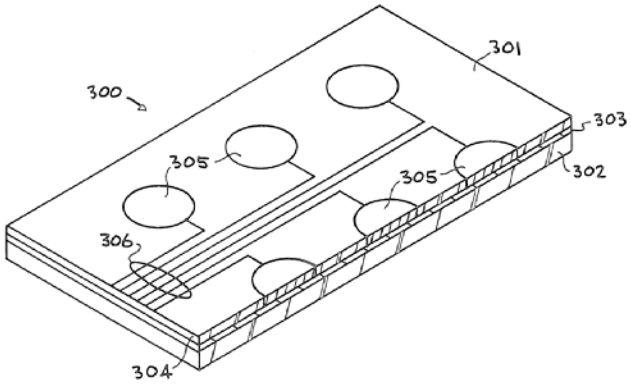
This technology entails a system of metallization in an integrated polymer microsystem, where conductive ink is applied to a flexible polymer substrate (silicon or PDMS). The flow chart above is one embodiment incorporating the present invention.

IL11102: SILICONE METALIZATION (US Patent 7,462,518)



This method provides a system for layering metal features on a polymer layer on a matrix. An electronic apparatus/device can be produced by the system.

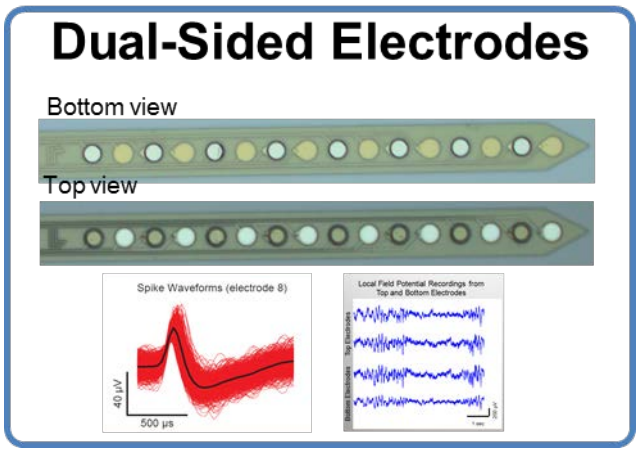
IL11168: PIN DEPOSITION OF CONDUCTIVE INKS FOR MICROELECTRODES AND CONTACT VIA FILLING (US Patent 7,036,220)

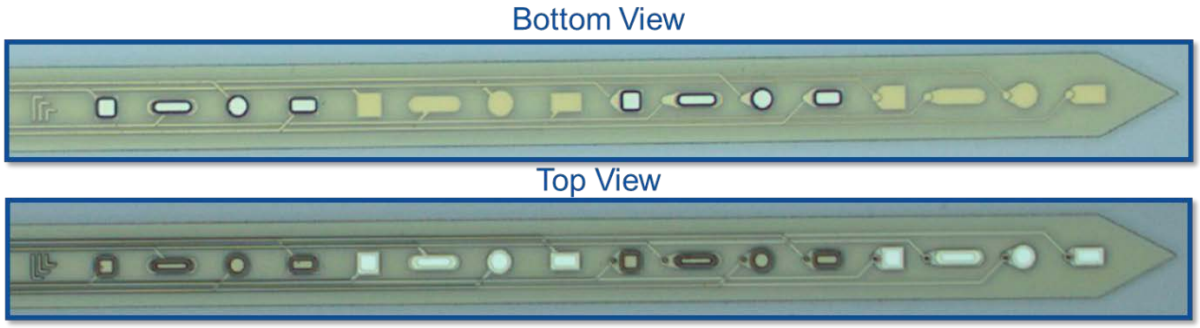


This technology is a method of metallization of an integrated microsystem, and uses application of small aliquots of conductive material onto the substrate to produce a circuit component.

This technique can be used in parallel extension, and automation of this method can be used for high throughput microelectrode fabrication and polymer-based hybrid systems fabrication.

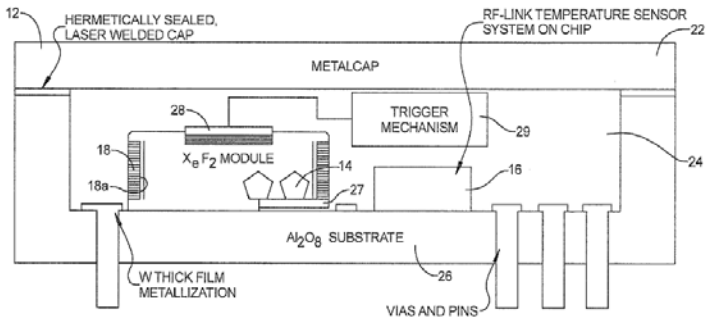
IL11997: METHOD OF FABRICATING CONDUCTIVE ELECTRODES ON THE FRONT AND BACKSIDE OF A THIN FILM STRUCTURE (US Patent 8,183,111)





This method is extremely useful in fabricating a thin film device having conductive front and backside electrodes or contacts. It overcomes conventional MEMS techniques to fabricate polymer that typically produce electrodes only on a top surface. This method also avoids bending/deforming the device, avoiding cracking/failing.

IL12810: SYSTEM AND METHOD FOR ON DEMAND, VANISHING, HIGH PERFORMANCE ELECTRONIC SYSTEMS (US Patent 9,294,098)

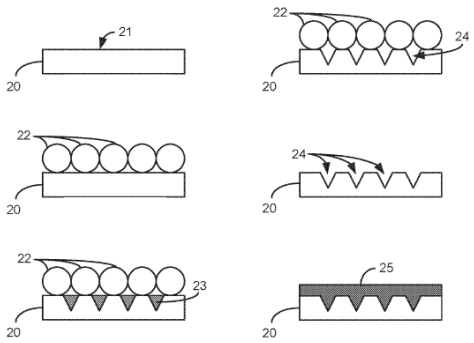


This technology encompasses an integrated circuit (IC) system with an IC component which is able to have its functionality destroyed upon receiving a command signal.

A heater component may be configured to heat the dissolving compound to a point of sublimation where the dissolving compound changes from a solid to a gaseous dissolving compound. A triggering mechanism may be used for initiating a dissolution process whereby the gaseous dissolving compound can attack the IC component and destroy a functionality of the IC component.

Transient electronics (able to disappear/be destroyed via signal or environmental factor) may find use in environmental sensors for the protection of sensitive property. Previous use of fluid reservoir is not practical and may not fully dissolve bio-compatible material.

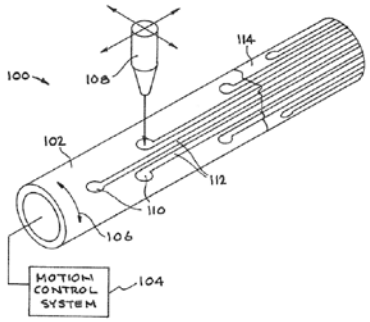
IL13045: METHOD FOR ELECTROCHEMICAL ROUGHENING OF THIN FILM ELECTRODES (US Patent Application US2017/0350034)



The present invention relates to surface roughening methods and more particularly to a method for electrochemical roughening of thin film electrodes for increasing active surface area, decreasing electrode impedance, and improving adhesion to substrates.

This technique may exhibit increased charge injection capacity (> 10x) compared to planar thin film electrodes.

IL12532: METHOD TO PATTERN <10 MICROMETER CONDUCTING AND PASSIVATING FEATURES ON 3D SUBSTRATES FOR IMPLANTABLE DEVICES (US patent 9,694,190)



A method to pattern an implantable device with a cylindrical base, and at least one electrode and electrically conducting lead on the base. The conducting lead has a feature size of <10 micrometers, and there is a protective coating on the cylindrical base that covers the lead. This method is highly repeatable, accurate, and simple.

Potential Applications

The inventions within this portfolio could be applied in various industries for a wide range of applications. They may find use wherever a system of metallization in an integrated flexible polymer microsystem is needed, such as: monitoring cargo shipments; tracking troops, individual personnel, and vehicle movement; and detecting chemical and biological signatures associated with various threats.

Additional applications may include: epiretinal, subretinal, and cortical artificial vision implants; cochlear implants, neurological implants, spinal cord implants, and other neural interface implants; implantable and transdennal drug delivery devices; arrays for deep brain stimulation, spinal cord reattachment, nerve regeneration, cortical implants; drug delivery, muscle stimulation and relaxation; flexible displays, conformable circuits, sensors, radios, recorders, cameras, cell phones, computers, calculators, and surveillance devices.

Many of the disclosed inventions are able to withstand severe environmental factors (temperature extremes, water submersion), are self-sufficient (integrated power, electronics, sensing, and communications), and can be fabricated in a bio-compatible manner, for interfacing with neurons and other excitable cells, or for use in other implantable biomedical devices (EEC, ECG, defibrillators, pacemakers, neural stimulators, neural recorders, etc.).

Development Status

LLNL is seeking industry partners with a demonstrated ability to bring such inventions to the market. Moving critical technology beyond the Laboratory to the commercial world helps our licensees gain a competitive edge in the marketplace. All licensing activities are conducted under policies relating to the strict nondisclosure of company proprietary information.

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