Publications with LPKF equipment

Selection of internationally published scientific articles using LPKF equipment

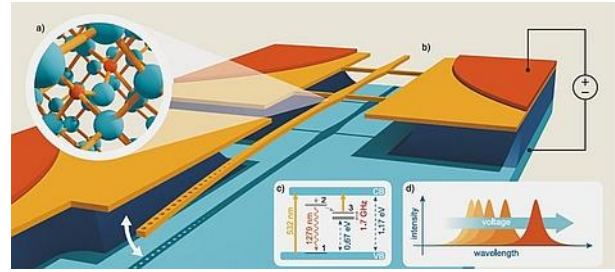


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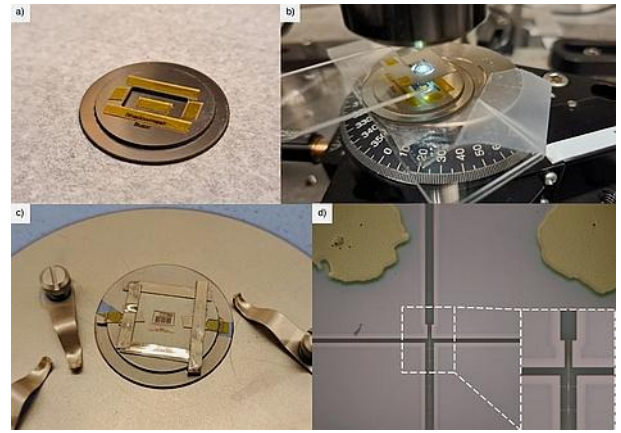
Spectral tuning and nanoscale localization of single color centers in silicon via controllable strain

silicon color centers; controllable strain; quantum photonics; spectral tuning; nanoscale localization; shadow-mask fabrication

The development of color centers in silicon enables scalable quantum technologies by combining telecom-wavelength emission and compatibility with mature silicon fabrication. However, large-scale integration requires precise control of each emitter's optical transition to generate indistinguishable photons for quantum networking. Here, we demonstrate a foundry-fabricated photonic integrated circuit (PIC) combining suspended silicon waveguides with a microelectromechanical (MEMS) cantilever to apply local strain and spectrally tune individual G-centers. Applying up to 35 V between the cantilever and the substrate induces a reversible wavelength shift of the zero-phonon line exceeding 100 pm, with no loss in brightness. Moreover, by modeling the strain-induced shifts with a digital twin physical model, ….



Shadowmask metal evaporation: Shadow mask evaporation is used to deposit electrical pads directly onto the chip, with chromium (50 nm) and gold (200 nm) serving as the contact materials. This technique avoids both liftoff, which could risk structural failure of the suspended waveguide, and dry metal etching, which may lead to contamination of the sample. By using a shadow mask, we minimize both the risk of structural collapse and potential chemical contamination. The shadow mask was fabricated from a 0.1 mm (4 mil) thick steel sheet using an **LPKF ProtoLaser U4** laser cutter at MIT's T.J. Rodgers Laboratory. The laser cutter produces precise patterning, achieving a smallest hole radius of 25 µm, with a minimum spacing of 40 µm between holes. The hole radius used to pattern the electrical pads was 50 µm.



Research Laboratory of Electronics, Massachusetts Institute of Technology, Cambridge, MA, USA

https://www.nature.com/articles/s41467-025-63871-8

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LPKF PROTOLASER U4

Material used:
DuPont Pyralux
Si-wafer, PDMS

Application area:
Implantable electronics

Published:
04/2025

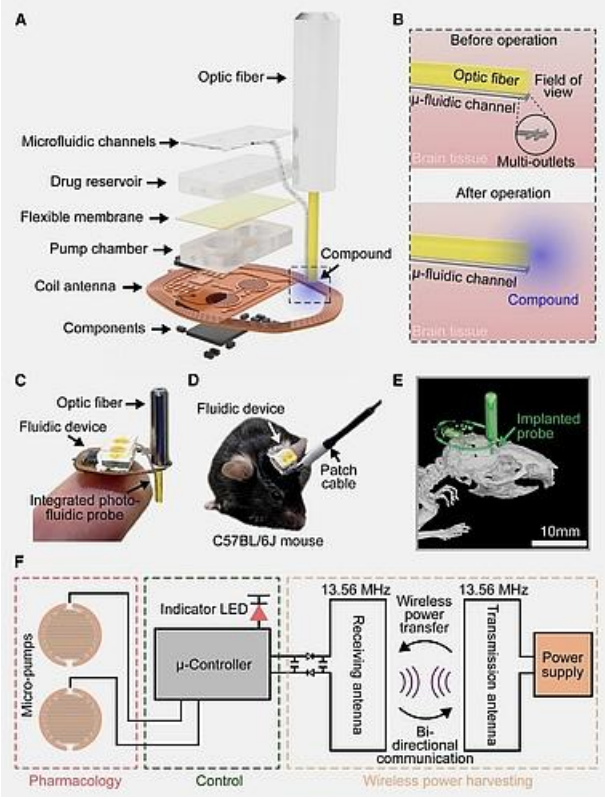
An integrated microfluidic and fluorescence platform for probing in vivo neuropharmacology

neuropharmacology, microfluidic, fiber photometry, intracranial drug delivery, biosensor, optogenetics, rodent behavior

Neurotechnologies and genetic tools for dissecting neural circuit functions have advanced rapidly over the past decade although the development of complementary pharmacological methodologies has comparatively lagged. Understanding the precise pharmacological mechanisms of neuroactive compounds is critical for advancing basic neurobiology and neuropharmacology, as well as for developing more effective treatments for neurological and neuropsychiatric disorders. However, integrating modern tools for assessing neural activity in large-scale neural networks with spatially localized drug delivery remains a major challenge. Here, we present a dual microfluidic-photometry..

Fabrication of Electronics: Fabrication of the flexible printed circuit board (fPCB) began with laser ablation of a sheet of Cu/PI/Cu (18 mm/75 mm /18 mm; Pyralux, DuPont Inc.), using an ultraviolet (UV) laser system (ProtoLaser U4, LPKF Inc.), to pattern both sides with circuit traces, bonding pads, coil antennas, and interdigitated electrodes.

Fabrication of the Microfluidic Probes: Photolithography and deep ion etching defined patterns of relief on a silicon (Si) wafer in the geometry and dimensions of the microfluidic structures. Spin-coating formed a layer of PDMS with a thickness of 100 um… A UV laser system (**ProtoLaser U4, LPKF** Inc.) defined the geometry of the microfluidic probe.



Department of Anesthesiology and Pain Medicine, University of Washington, Seattle, WA, USA

https://rogersgroup.northwestern.edu/files/2025/neuronmicrofl.pdf

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LPKF PROTOLASER U4

Material used:

FR4

Application area:

Microfluidic

Published:

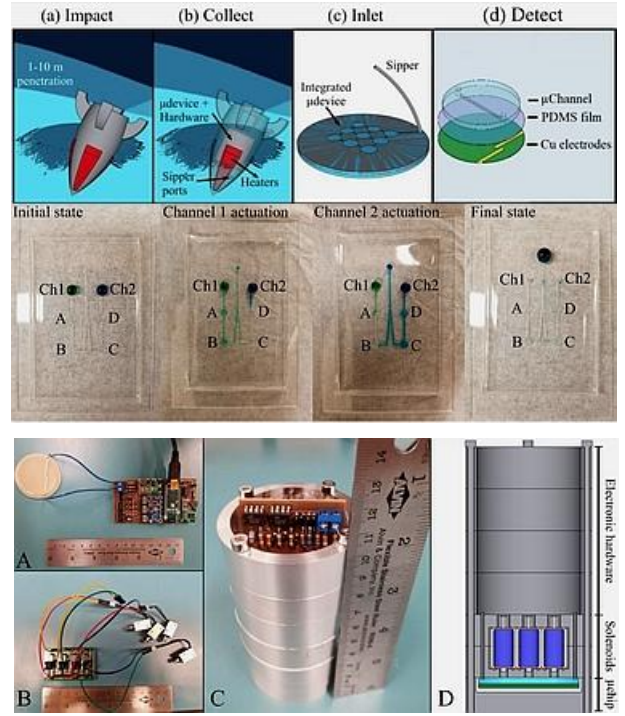
12/2024

Early Technology Readiness Level (TRL) Development of the Microfluidic Inorganic Conductivity Detector for Europa and the Solenoid-Based Actuator Assembly for Impact Penetrators

Instrumentation, exobiology, solar system origin, prebiotic chemistry

This study introduces an innovative in situ lander/impact-penetrator design tailored for Discovery-class missions to Europa, specifically focused on conducting astrobiological analyses. The platform integrates a microfluidic capacitively coupled contactless conductivity detector (C4D), optimized for the detection of low-concentration salts potentially indicative of biological activity. Our microfluidic system allows for automated sample routing and precise conductivity-based detection, making it suitable for the harsh environmental and logistical demands of Europa's icy surface. This technology provides a robust toolset for exploring extraterrestrial habitability by enabling in situ chemical …

MicroICE Device Miniaturization: A breadboard version of the C4D hardware was built for initial tests, followed by the printed circuit board (PCB) version using a commercial PCB plotter (LPKF Laser & Electronics, Model: **ProtoMat S**, Fürth, Germany) and laser etching (LPKF Laser & Electronics, Model: **ProtoLaser U4**, Fürth, Germany). The dimensions of the board were dictated by the IceShIP canister and therefore had a footprint of 9 × 4.5 cm2. The breadboard and the PCB hardware performances were compared by making calibration plots for two lab-prepared salts on the same MicroICE device.



Georgia Institute of Technology, School of Chemistry and Biochemistry, 901 Atlantic Dr. NW, Atlanta, GA 30332, USA

https://pmc.ncbi.nlm.nih.gov/articles/PMC11644930/

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LPKF ProtoLaser U4

Material used:

Flex N/A

Application area:

Bioresorbable electronic

Published:

4/2024

Ultrathin, Transferred Layers of Silicon Oxynitrides as Tunable Biofluid Barriers for Bioresorbable Electronic Systems

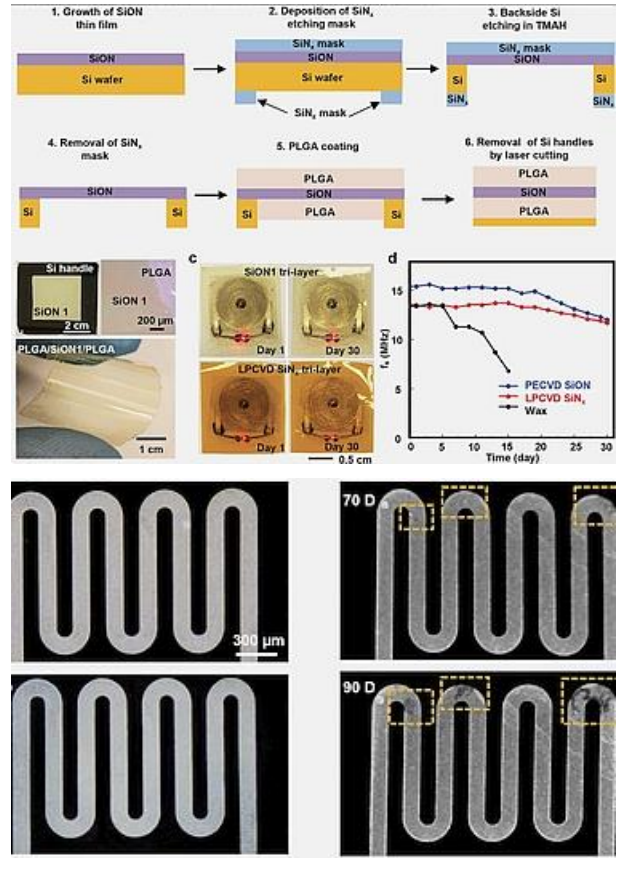
biofluid barriers; bioresorbable electronics; electronics packaging; silicon oxynitrides; transient electronic

Bio/ecoresorbable electronic systems create unique opportunities in implantable medical devices that serve a need over a finite time period and then disappear naturally to eliminate the need for extraction surgeries. A critical challenge in the development of this type of technology is in materials that can serve as thin, stable barriers to surrounding ground water or biofluids, yet ultimately dissolve completely to benign end products. This paper describes a class of inorganic material (silicon oxynitride, SiON) that can be formed in thin films by plasma-enhanced chemical vapor deposition for this purpose. In vitro studies suggest that SiON and its dissolution products are …

Fabrication of Bioresorbable Devices Encapsulated by Trilayer Materials: The bioresorbable device here consisted of an RF energy harvester, which included two Mo coils (thickness: ≈50 µm) stacked on top of one another and spaced with an ≈10 µm thick PLGA dielectric layer. The energy harvester provided wireless power to a commercial LED. A UV laser cutter (LPKF, ProtoLaser U4) defined the coil structure by selectively removing Mo. Conductive wax electrically connected all components of the device. Two pieces of trilayer materials bonded above and below the device by heating to 70 °C for 15 min sealed the system. To minimize leakage issues at the edges during the PBS soaking test, biodegradable polyanhydrides were utilized to cover the entire wireless device.

Querrey Simpson Institute for Bioelectronics, Northwestern University, Evanston, IL 60208, USA

https://onlinelibrary.wiley.com/doi/10.1002/adma.202307782



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LPKF ProtoLaser U4

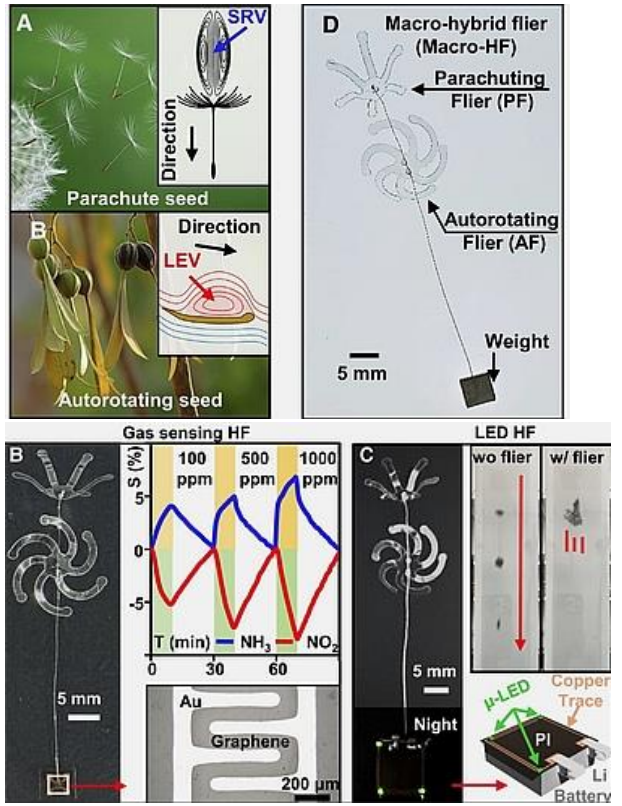
Material used:
PLGA, Dupont Pyralux AP8535R

Application area:
Passive flying system

Published:
03/2024

Functional bio-inspired hybrid fliers with separated ring and leading edge vortices

bio-inspired design, aerodynamics, fluid mechanics, 3D fabrication, soft electronics



Recent advances in passive flying systems inspired by wind-dispersed seeds contribute to increasing interest in their use for remote sensing applications across large spatial domains in the Lagrangian frame of reference. These concepts create possibilities for developing and studying structures with performance characteristics and operating mechanisms that lie beyond those found in nature. Here, we demonstrate a hybrid flier system, fabricated through a process of controlled buckling, to yield unusual geometries optimized for flight. Specifically, these constructs simultaneously exploit distinct fluid phenomena, including separated vortex rings from features that resemble those of dandelion…

Fabrication and measurement of the LED HF: Pyralux AP8535R served as a substrate for the circuit. The top copper layer (17.5 µm thick) and traces for the LED (0.65 mm × 0.35 mm × 0.2 mm) were structured via direct laser ablation (**LPKF U4**). Hot-air soldering using low-temperature solder 637 (Indium Corp., Clinton, NY) bonded LEDs (Green 571 nm LED, Digi-Key Electronics, MN) to the respective pads. An ultralow-weight lithium-ion battery (0.33 g, 3 mm × 9 mm × 10 mm, PowerStream Technology, UT) supplied power to the LED.

Fabrication of 2D precursors in PLGA began with laser ablation to define shape selected based on …

Department of Mechanical Engineering, Pohang University of Science and Technology, Pohang 37673, Republic of Korea

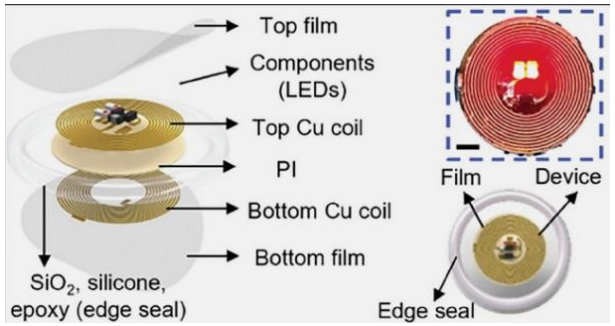
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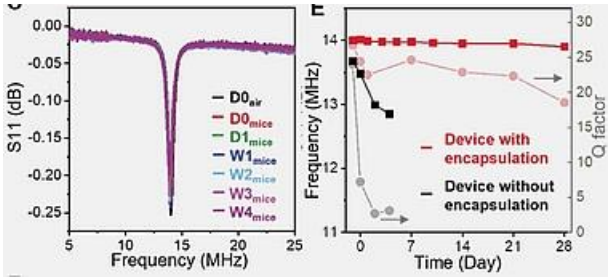
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Bioresorbable Multilayer Organic–Inorganic Films for Bioelectronic Systems

Bioresorbable electronic, SION-PA

Bioresorbable electronic devices as temporary biomedical implants represent an emerging class of technology relevant to a range of patient conditions currently addressed with technologies that require surgical explantation after a desired period of use. Obtaining reliable performance and favorable degradation behavior demands materials that can serve as biofluid barriers in encapsulating structures that avoid premature degradation of active electronic components. Here, this work presents a materials design that addresses this need, with properties in water impermeability, mechanical flexibility, and processability that are superior to alternatives.





Fabrication: The implantable LED devices used designs modified from flexible near-field wireless optoelectronic systems reported previously for optogenetics applications.[49] The device consisted of two circular Cu coils (diameter: 6 mm,10 turns; thickness: 18 µm; dielectric layer: 75-µm polyimide) with surface-mounted electronic components for power transfer. Power transfer uses magnetic coupling to a separate RF transmission loop antenna or a wireless powering system operating at 13.56 MHz. Device fabrication began with patterning a flexible substrate made of a copper–PI–copper laminate (Pyralux, DuPont, USA) using laser ablation (LPKF, **ProtoLaser U4**, Germany) to define the circuit interconnects and the bonding pads for the electronic components.

Querrey Simpson Institute for Bioelectronics, Northwestern University, Evanston, IL, 60208, USA

https://onlinelibrary.wiley.com/doi/10.1002/adma.202309421

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LPKF ProtoLaser U4

Material used:
MA–MA, MA-UDMA Acrylate-IBA

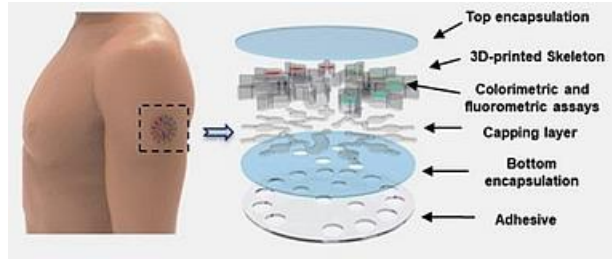
Application area:
Wearable medical sensor

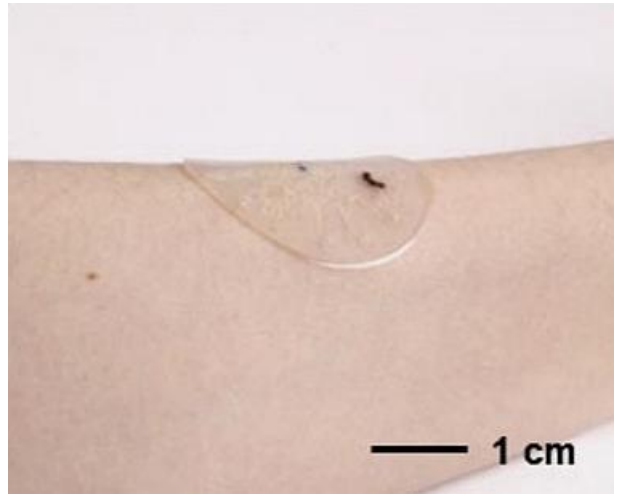
Published:
08/2023

3D-printed epidermal sweat microfluidic systems with integrated microcuvettes for precise spectroscopic and fluorometric biochemical assays

microfluidics, microcuvettes,

Systems for capture, storage and analysis of eccrine sweat can provide insights into physiological health status, quantify losses of water, electrolytes, amino acids and/or other essential species, and identify exposures to adverse environmental species or illicit drugs. Recent advances in materials and device designs serve as the basis for skin-compatible classes of microfluidic platforms and in situ colorimetric assays for precise assessments of sweat rate, sweat loss and concentrations of wide-ranging types of biomarkers in sweat. This paper presents a set of findings that enhances the performance of these systems through the use of microfluidic networks, integrated valves …





The soft and elastic properties of the Acrylate-IBA facilitates demolding from a UV curable optical adhesive (NOA63, Norland Products Inc., NJ, USA), selected as the skeletal material for its high transparency (Average of 500–700 nm: 90.6%), low fluorescence background intensity (Fig. S11, ESI†), and high modulus (Young's modulus: 1.1 GPa). An ultraviolet laser system (**ProtoLaser U4**, LPKF, Germany) removes excess materials and defines the overall profile the molded structure. As with the 3D printed examples, these molded parts can be loaded with chemical assays, capped with adhesives and encapsulated in PDMS to yield complete devices.

Querrey Simpson Institute for Bioelectronics, Northwestern University, Evanston, IL 60208

https://pubs.rsc.org/en/content/articlelanding/2023/mh/d3mh00876b

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LPKF ProtoLaser U3

Material used:

NdFeB, Ecoflex

Application area:

Medical devices

Published:

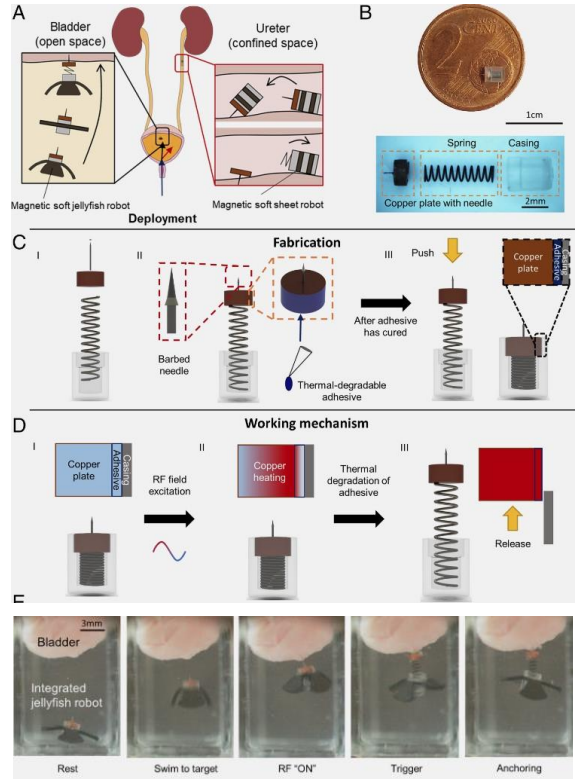
08/2022

LPKF Laser & Electronics

On-demand anchoring of wireless soft miniature robots on soft surfaces

Wireless medical robots, soft robots. miniature robots, surface anchoring

Untethered soft miniature robots capable of accessing hard-to-reach regions can enable new, disruptive, and minimally invasive medical procedures. However, once the control input is removed, these robots easily move from their target location because of the dynamic motion of body tissues or fluids, thereby restricting their use in many long-term medical applications. To overcome this, we propose a wireless spring-preloaded barbed needle release mechanism, which can provide up to 1.6 N of force to drive a barbed needle into soft tissues to allow robust on-demand anchoring on three-dimensional (3D) surfaces. The mechanism is wirelessly triggered using a radio-frequency remote…



Wireless Magnetic Soft Millirobot Fabrication.
The soft millirobots were fabricated with a method described previously (10). Briefly, Scotch tape (840, 3M) was first placed along the sides of an acrylic sheet. The number of layers placed determined the thickness of the robot. Neodymium-iron-boron (NdFeB) magnetic microparticles (MQP-15–7, Magnequench) were mixed with platinum-catalyzed silicone (Ecoflex 00-10, Smooth-On Inc.) in a 1:1 mass ratio, degassed for 5 min, poured on the acrylic sheet, and evened out with a razor blade. The sample was then left to cure on a hot plate at 65 °C for 1 h. After the sample had cured, it was laser cut (**ProtoLaser U3**, LPKF Laser & Electronics AG) to the desired dimensions.

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https://www.pnas.org/doi/10.1073/pnas.2207767119

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LPKF ProtoMat S100

Material used: **PMMA**

Application area: **Microfluidics**

Published: **5/2022**

Plant-inspired TransfOrigami microfluidics

shape-adaptive flexible electronics, photomicroreactor,



The healthy functioning of the plants' vasculature depends on their ability to respond to environmental changes. In contrast, synthetic microfluidic systems have rarely demonstrated this environmental responsiveness. Plants respond to environmental stimuli through nastic movement, which inspires us to introduce transformable microfluidics: By embedding stimuli-responsive materials, the microfluidic device can respond to temperature, humidity, and light irradiance. Furthermore, by designing a foldable geometry, these responsive movements can follow the preset origami transformation. We term this device TransfOrigami microfluidics (TOM) to highlight the …

Design and working method of an optical flow cell: The optical flow cell was designed using AutoCAD (Autodesk) and fabricated via precision micromilling (LPKF ProtoMat S100) of black PMMA as described previously (67). Briefly, the flow cell is composed of two interlocking micromilled PMMA pieces with a channel cut into both pieces such that the 0.7-mm OD tubing (polytetrafluoroethylene, thin wall tubing, UT5, Adtech Polymer Engineering Ltd., UK) can fit into it. The light-to-voltage converter (photodiode, TSL257, ams AG, Austria) and light-emitting diode (LED; 370 nm; SST-10-UV-B130-E365-00, Luminus Devices, UK) are placed in the micromilled parts in a way that light emitted from an LED travels to an opposing photodiode via tubing (path length of 0.5 mm).

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https://www.science.org/doi/10.1126/sciadv.abo1719

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LPKF ProtoLaser U3

Material used: **FR4**

Application area: **MEMS Sensor**

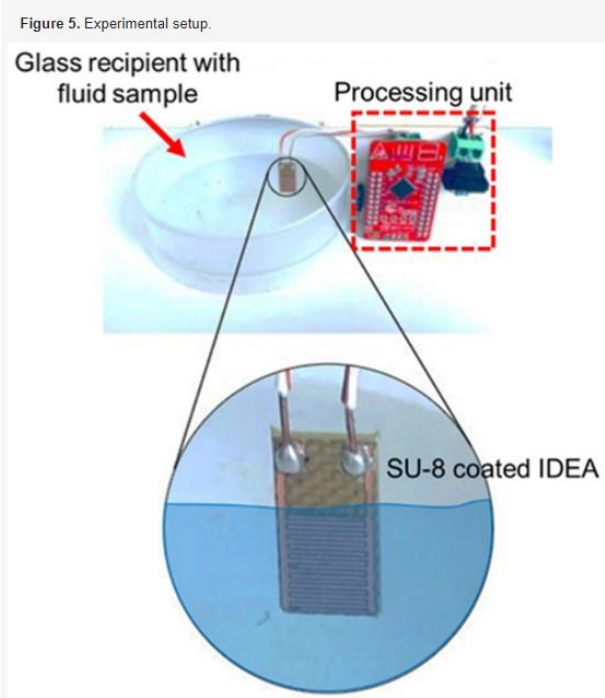
Published: **09/2021**

Sensitivity Analysis of a Portable Wireless PCB-MEMS Permittivity Sensor Node for Non-Invasive Liquid Recognition

MEMS, Permittivity Sensor, liquid recognition

ielectric characteristics are useful to determine crucial properties of liquids and to differentiate between liquid samples with similar physical characteristics. Liquid recognition has found applications in a broad variety of fields, including healthcare, food science, and quality inspection, among others. This work demonstrates the fabrication, instrumentation, and functionality of a portable wireless sensor node for the permittivity measurement of liquids that require characterization and differentiation. The node incorporates an interdigitated microelectrode array as a transducer and a microcontroller unit with radio communication electronics for data processing …

The ablation processing unit used in this work (LPKF ProtoLaser U3, LPKF Laser & Electronics, Garbsen, Germany) comprises a Nd:YAG laser operating at a wavelength of 355 nm, with a transversal intensity characterized by a Gaussian profile. The focused laser beam has a diameter of 12 µm. The laser was configured with an average power of 4.49 W and a pulse frequency of 53.75 kHz. The PCB consists of a 1.6 mm-thick FR4 substrate covered by an 18 µm-thick Cu layer on one of the planar surfaces. The IDEA pattern was designed in a Computer Aided Design (CAD) software and was then loaded on the ablation processing unit to transfer the pattern to the Cu layer of the PCB.



Tecnologico de Monterrey, School of Engineering and Sciences, Ave. Eugenio Garza Sada 2501, Monterrey 64849, Mexico

https://www.mdpi.com/2072-666X/12/9/1068/htm

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LPKF ProtoLaser U4

Material used:
Pyralux AP8535R, Si-wafer, glass,…

Application area:
Wearable biosensor

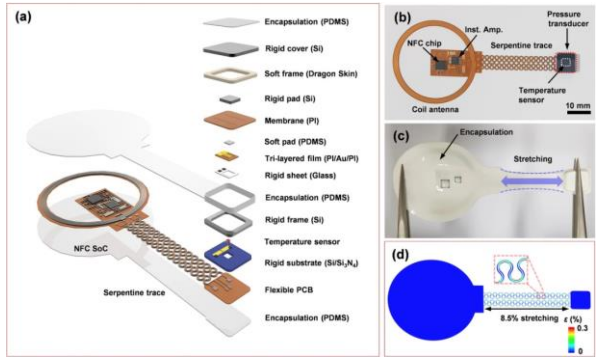
Published:
08/2021

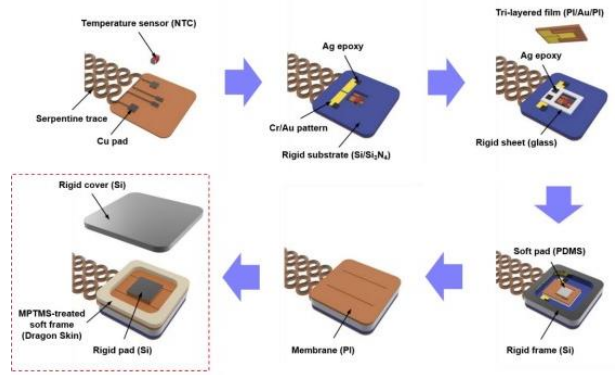
LPKF Laser & Electronics

Battery-free, wireless soft sensors for continuous multi-site measurements of pressure and temperature from patients at risk for pressure injuries

bio-medical devices, health monitoring, wireless electronics, flexible electronics,

Capabilities for continuous monitoring of pressures and temperatures at critical skin interfaces can help to guide care strategies that minimize the potential for pressure injuries in hospitalized patients or in individuals confined to the bed. This paper introduces a soft, skin-mountable class of sensor system for this purpose. The design includes a pressure-responsive element based on membrane deflection and a battery-free, wireless mode of operation capable of multi-site measurements at strategic locations across the body. Such devices yield continuous, simultaneous readings of pressure and temperature in a sequential readout scheme from a pair of primary antennas mounted under …





Fabrication of the battery-free, wireless electronic system

Fabrication began with patterning a flexible PCB substrate (Pyralux AP8535R, DuPont) to define electrical connections, vias, and the device outline with a direct UV (355-nm) laser ablation system (ProtoLaser U4, LPKF), followed by ultrasonic cleaning successively in oxide remover (Flux, Worthington Inc) for 2 min, deionized (DI) water for 2 min, and isopropyl alcohol (IPA, MG Chemicals) for 2 min to remove oxidation and organic residue. Electronic components included an NFC SoC (RF430FRL152H, Texas Instruments), an instrumentation amplifier (INA333, Texas Instruments), resistors, and capacitors, each placed using reflow soldering with low-temperature, solder paste…

Center for Bio-Integrated Electronics, Northwestern University, Evanston, IL, USA

https://www.nature.com/articles/s41467-021-25324-w

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LPKF ProtoLaser U4

Material used: **COP**

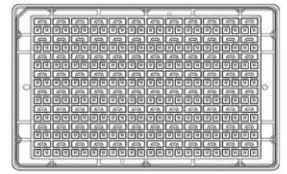
Application area: **Biomedical engineering**

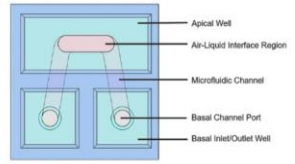
Published: **07/2021**

LPKF Laser & Electronics

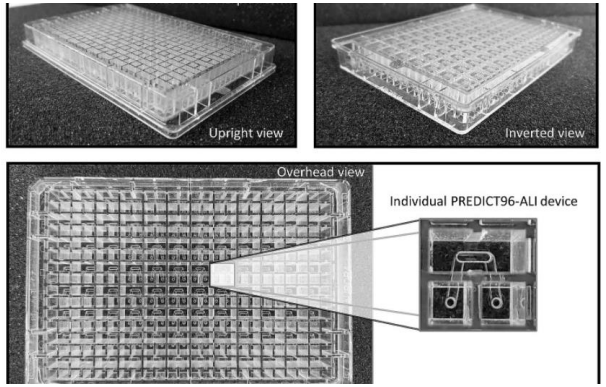
High-throughput human primary cell-based airway model for evaluating influenza, coronavirus, or other respiratory viruses in vitro

microfluidics, organ-on-chip, viral infection, SARS-CoV-2





Influenza and other respiratory viruses present a significant threat to public health, national security, and the world economy, and can lead to the emergence of global pandemics such as from COVID-19. A barrier to the development of effective therapeutics is the absence of a robust and predictive preclinical model, with most studies relying on a combination of in vitro screening with immortalized cell lines and low-throughput animal models. Here, we integrate human primary airway epithelial cells into a custom-engineered 96-device platform (PREDICT96-ALI) in which tissues are cultured in an array of microchannel-based culture chambers at an air–liquid interface, in a configuration …



To fabricate the PREDICT96-ALI culture plate, a UV laser system (Protolaser U4: LPKF Laser and Electronics, Garbsen, Germany) was used to laser-cut thin films of cyclic olefin polymer (COP) (ZF14-188: Zeon Corp., Tokyo, Japan) and cyclic olefin copolymer (8007 COC: Tekni-plex, Wayne, PA, USA). The COP layers were adhered together using low-glass transition temperature COC in a heated hydraulic press (Carver Inc., Wabash, IN, USA), and were separated with a 24 µm-thick track-etched polycarbonate membrane with pore diameter of 0.4 or 1 µm (It4ip S.A., Louvain-la-Neuve, Belgium) patterned with an array of holes to provide fluidic access ports to the bottom channel. The microfluidic stack is attached to a modified 384-well COP plate (Aurora Microplates, Whitefish, …

Bioengineering Division, Draper, Cambridge, MA, 02139, USA

https://www.nature.com/articles/s41598-021-94095-7

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LPKF ProtoLaser U3

Material used: **LCE, MRE**

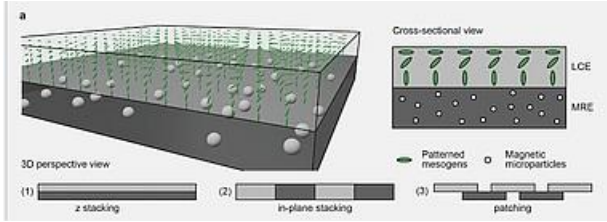
Application area: **Material research**

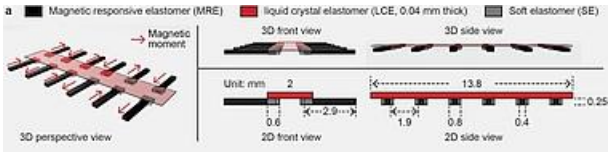
Published: **05/2021**

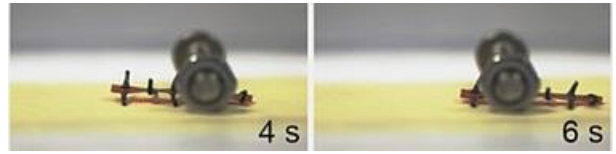
Wirelessly Actuated Thermo- and Magneto-Responsive Soft Bimorph Materials with Programmable Shape-Morphing

Soft materials, smart materials, shape-morphing, miniature robot

Soft materials that respond to wireless external stimuli are referred to as “smart” materials due to their promising potential in real-world actuation and sensing applications in robotics, microfluidics, and bioengineering. Recent years have witnessed a burst of these stimuli-responsive materials and their preliminary applications. However, their further advancement demands more versatility, configurability, and adaptability to deliver their promised benefits. Here, a dual-stimuli-responsive soft bimorph material with three configurations that enable complex programmable 3D shape-morphing is presented. The material consists of liquid crystal elastomers (LCEs) and …







Bimorph Materials

The reported bimorph material with various integration configurations was prepared by placing LCEs in the modes prior to the casting of MREs or on top of the casted MREs. The curing of MREs formed a bond between LCEs and MREs. Devices were made of the material via laser cutting (ProtoLaser, LPKF Laser & Electronics AG) according to designs made in a software (AutoCAD, Autodesk Inc.). A magnetization profile was then programmed into the device by deforming it and magnetizing it in a strong magnetic field (1.8 T) generated by a VSM (EZ7, Microsense).

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https://onlinelibrary.wiley.com/doi/10.1002/adma.202100336

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LPKF ProtoLaser U4

Material used: **Pyralux AP8535R**

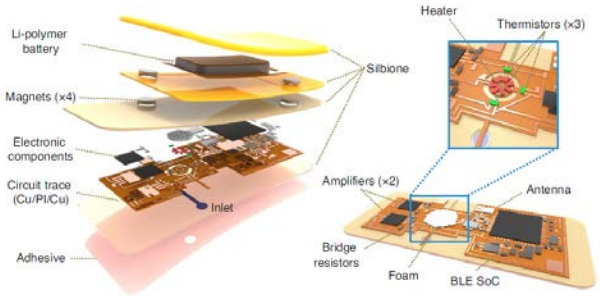
Application area: **Bio-medical research**

Published: **03/2021**

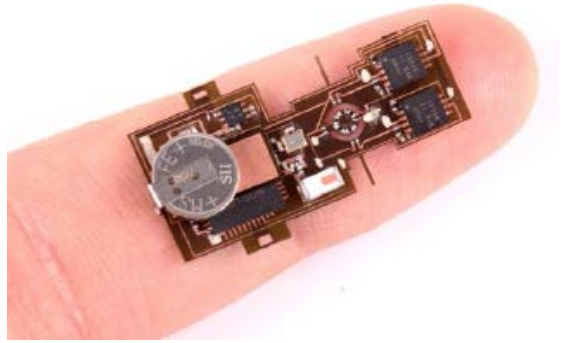
An on-skin platform for wireless monitoring of flow rate, cumulative loss and temperature of sweat in real time

Biomedical engineering, health care, microfluidics

Monitoring the flow rate, cumulative loss and temperature of sweat can provide valuable physiological insights for the diagnosis of thermoregulatory disorders and illnesses related to heat stress. However, obtaining accurate, continuous estimates of these parameters with high temporal resolution remains challenging. Here, we report a platform that can wirelessly measure sweat rate, sweat loss and skin temperature in real time. The approach combines a short, straight fluid passage to capture sweat as it emerges from the skin with a flow sensor that is based on a thermal actuator and precision thermistors, and that is physically isolated from, but thermally coupled to, the sweat.



Fabrication of the electronics. A thin, flexible film (AP8535R, Pyralux, DuPont) of copper/PI/copper (thicknesses of 18 µm, 75 µm and 18 µm) served as a substrate. An ultraviolet laser cutter (Protolaser U4, LPKF) ablated the copper to define conductive traces, bond pads and through-hole vias, resulting in a flexible printed circuit board (fPCB). A silver conductive paint (cat. no. Z05001, SPI Supplies) created conductive plugs between the top and bottom patterned copper layers through the vias when heated at 90 °C using a heat gun (AOYUE Int866). Soldering paste (TS391LT, Chip Quik) was used to join the various surface-mounted components, including the BLE SoC (nRF52832, Nordic Semiconductor), antenna (2450AT18A100, Johanson Technology), amplifier …



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http://rogersgroup.northwestern.edu/files/2021/nelectflow.pdf

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LPKF ProtoLaser R

Material used: **PI**

Application area: **Medical research**

Published: **10/2020**

Soft, skin-interfaced microfluidic systems with integrated immunoassays, fluorometric sensors, and impedance measurement capabilities

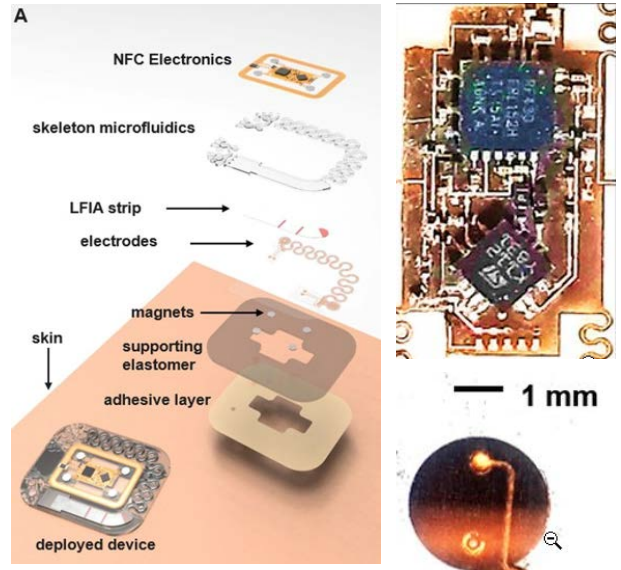
Soft microfluidic systems that capture, store, and perform biomarker analysis of microliter volumes of sweat, in situ, as it emerges from the surface of the skin, represent an emerging class of wearable technology with powerful capabilities that complement those of traditional biophysical sensing devices. Recent work establishes applications in the real-time characterization of sweat dynamics and sweat chemistry in the context of sports performance and healthcare diagnostics. This paper presents a collection of advances in biochemical sensors and microfluidic designs that support multimodal operation in the monitoring of physiological signatures directly correlated to physical …

Electronics Design and Assembly: Fabrication began with patterning of a two-layer printed circuit board by processing of multilayer foils of Cu–PI–Cu (18 µm/75 µm/18 µm) with a UV laser cutter (ProtoLaser U4; LPKF). The main processor, RF430FRL152HCRGER (RF430, ISO/IEC 15693, ISO/IEC 18000-3; Texas Instruments), served as the NFC platform, with the ability to rectify incident power from a smartphone device at up to 720 µW at 2.0 V, depending on coupling efficiency, and relaying data over the 13.56-MHz communications link. The RF430 supports 14-bit Sigma-Delta ADC with triple analog inputs at an input range up to 900 mV and maximum sampling frequency of 2 kHz, down-sampled to 1-Hz resolution. Signal amplification and measurement of the main and …

Querrey Simpson Institute for Bioelectronics, Northwestern University, Evanston, IL 60208

https://www.pnas.org/content/117/45/27906

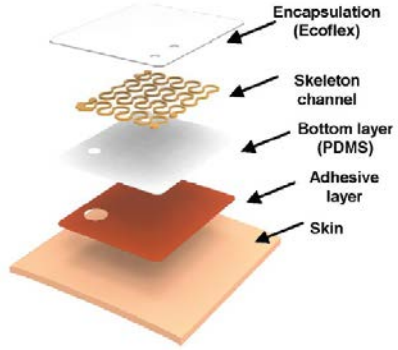
Healthcare, soft materials, epidermal devices, sweat cortisol

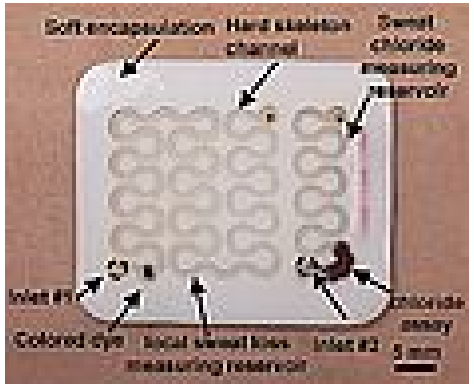


Skin-Interfaced Microfluidic Systems that Combine Hard and Soft Materials for Demanding Applications in Sweat Capture and Analysis

microfludic devices, sweat analysis, wearable devices

Eccrine sweat contains a rich blend of electrolytes, metabolites, proteins, metal ions, and other biomarkers. Changes in the concentrations of these chemical species can indicate alterations in hydration status and they can also reflect health conditions such as cystic fibrosis, schizophrenia, and depression. Recent advances in soft, skin-interfaced microfluidic systems enable real-time measurement of local sweat loss and sweat biomarker concentrations, with a wide range of applications in healthcare. Uses in certain contexts involve, however, physical impacts on the body that can dynamically deform these platforms, with adverse effects on measurement reliability.





Fabrication:

… An automated cutting system based on a pulsed laser (LPKF ProtoLaser R, Germany) defined the outline of the serpentine skeletal geometry from the NOA microchannel system. Pouring PDMS(Sylgard 184; Dow corning, MI, USA; mixing ratio of base to curing agent: 10:1) mixed with white silicone dye (Reynolds Advanced Materials) at 10% wt on the PMMA-coated silicon wafer and spin-casting at 300 rpm generated a bottom substrate layer with thickness of 250 µm. Corona treating the NOA skeletal and the white PDMS layer enabled strong bonding between them. Pouring a low modulus silicone precursor (Ecoflex 35) on top after corona treatment, spinning at 150 rpm …

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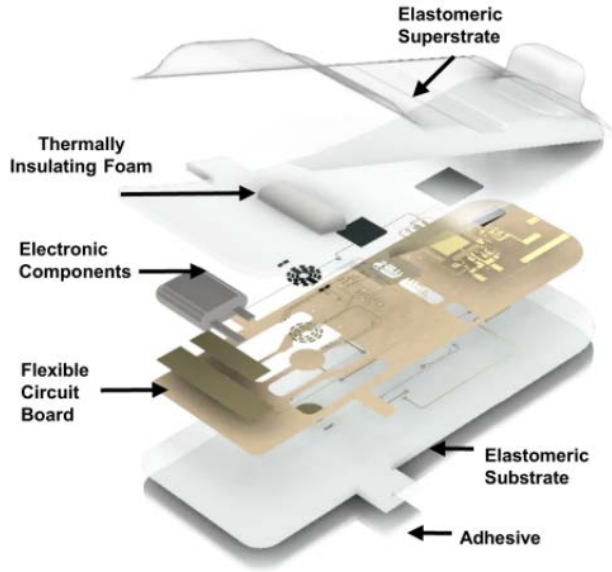
http://rogersgroup.northwestern.edu/files/2021/adhmskeleton.pdf

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Continuous, noninvasive wireless monitoring of flow of cerebrospinal fluid through shunts in patients with hydrocephalus

wearable device, wireless,, continuous flow monitoring

Hydrocephalus is a common disorder caused by the buildup of cerebrospinal fluid (CSF) in the brain. Treatment typically involves the surgical implantation of a pressure-regulated silicone tube assembly, known as a shunt. Unfortunately, shunts have extremely high failure rates and diagnosing shunt malfunction is challenging due to a combination of vague symptoms and a lack of a convenient means to monitor flow. Here, we introduce a wireless, wearable device that enables precise measurements of CSF flow, continuously or intermittently, in hospitals, laboratories or even in home settings. The technology exploits measurements of thermal transport…



Fabrication and assembly of electronics

Fabrication of the sensor and supporting electronics began with processing of a trilayer film of copper/PI/copper (18 µm/75 µm/18 µm, Pyralux, DuPont Inc.) with a UV laser cutter (LPKF U4) to pattern traces, bond pads, and unplated vias. Successive washes in stainless steel flux (Worthington Inc), deionized water, and isopropanol (Fisher Scientific) removed surface oxides and prepared the resulting flexible PCB (fPCB) for assembly. Reflow soldering with low-temperature solder paste (TS391LT, ChipQuik) established electrical contacts between commercial-off-the-shelf components…

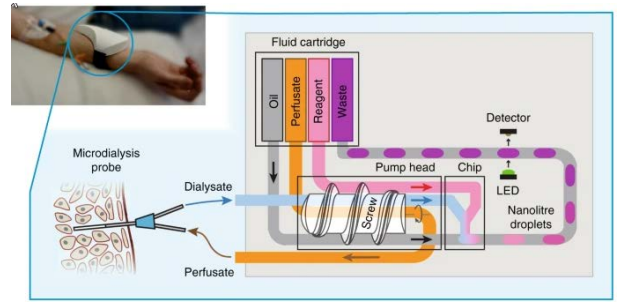
Department of Materials Science and Engineering, Frederick Seitz Materials Research Laboratory, University of Illinois at Urbana-Champaign, Urbana, IL, 61801, USA

https://www.nature.com/articles/s41746-020-0239-1

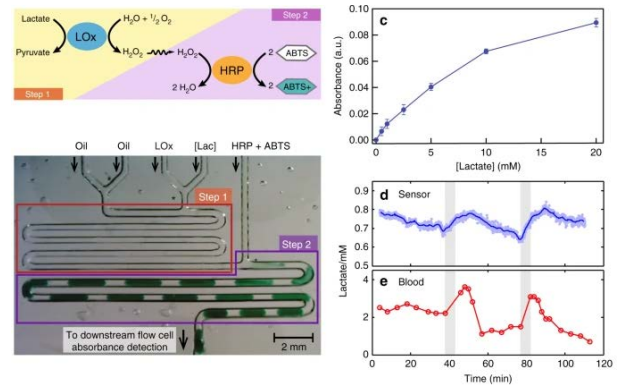
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Monitoring biomolecule concentrations in tissue using a wearable droplet microfluidic-based sensor

Wearable sensor, microfluidic, in situ analysis, biomarker



Knowing how biomarker levels vary within biological fluids over time can produce valuable insight into tissue physiology and pathology, and could inform personalized clinical treatment. We describe here a wearable sensor for monitoring biomolecule levels that combines continuous fluid sampling with in situ analysis using wet-chemical assays (with the specific assay interchangeable depending on the target biomolecule). The microfluidic device employs a droplet flow regime to maximize the temporal response of the device, using a screw-driven push-pull peristaltic micropump to robustly produce nanolitre-sized droplets. The fully integrated sensor is contained within a small …



Flow cell design and setup

The flow cell, shown in Supplementary Fig. 11, was based on a previously reported design31 and consisted of a black acrylic body which held the optical components and directed the light path through the fluid as it passed through PTFE tubing. The body was micromilled using a LPKF Protomat S100 micromill (LPKF Laser & Electronics Ltd., Berkshire, UK) from two 3 mm-thick black polymethylmethacrylate (PMMA) blocks. A straight centre groove of dimension 1.0 mm by 1.0 mm was milled to take the PTFE tubing. Perpendicular to the groove, a through-hole of square cross-section (0.4 mm) was milled to direct the light path. Recesses at each end of the through-hole …..

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