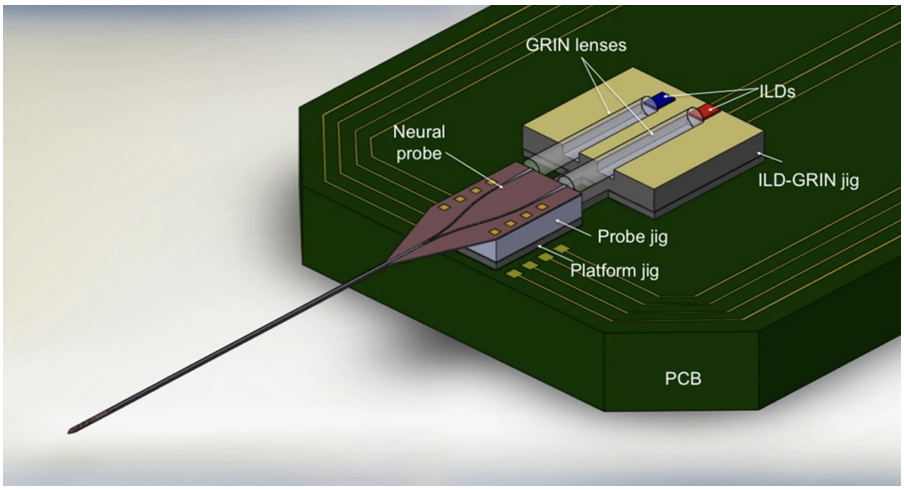
INNOVATION PARTNERSHIPS
UNIVERSITY OF MICHIGAN

Fiberless Optoelectrodes for Multicolor Neural Stimulation

TECHNOLOGY NUMBER: 6575



OVERVIEW

Multicolor fiberless optoelectrode for precise neural circuit analysis and modulation

- Enables multicolor neural modulation and recording with no bulky optical fibers
- Brain research, optogenetic studies, neural circuit mapping, neuroscience tool enhancement

BACKGROUND

Optogenetics is revolutionizing neuroscientific research by allowing targeted control of neurons using light. This technique involves genetically modifying specific neurons to express light-sensitive proteins (opsins), enabling precise activation or inhibition based on light wavelengths. Historically, light delivery in optogenetics required bulky optical fibers or large surface-mounted light sources that often activated unintended neurons and limited spatial specificity. Such assemblies were manually constructed, resulting in cumbersome designs that restricted in vivo applicability, particularly in smaller and denser brain regions. The need for a compact, scalable solution that provides multicolor light delivery with simultaneous electrical data recording has grown, particularly as the repertoire of opsins continues to expand. Tetherless, high-precision modulation devices that can target specific neuronal sub-populations without invasive fiber optics are crucial for advancing the spatial and temporal fidelity in neural control.

INNOVATION

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Category

Medical Devices
Engineering & Physical Sciences
Semiconductor, MEMS, and Electronics

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Researchers at the University of Michigan have developed fiberless multicolor optoelectrode leveraging a monolithically integrated optical waveguide to deliver precise multicolor light. By combining a side-emitting injection laser diode with a dielectric optical waveguide mixer via a gradient-index (GRIN) lens, this innovation attains efficient optical coupling and thermal isolation. This integrated approach permits multicolor modulation at a single waveguide port, offering precise control of neural populations in vivo. Validations in mice expressing Channelrhodopsin-2 and Archaerhodopsin demonstrated high-fidelity activation and silencing of the same neurons, showcasing its capability to independently modulate neural groups within dense brain regions.

ADDITIONAL INFORMATION

REFERNCES

"Fiberless multicolor neural optoelectrode for in vivo circuit analysis"

INTELLECTUAL PROPERTY

US10695581 "Multicolor neural optoelectrode"