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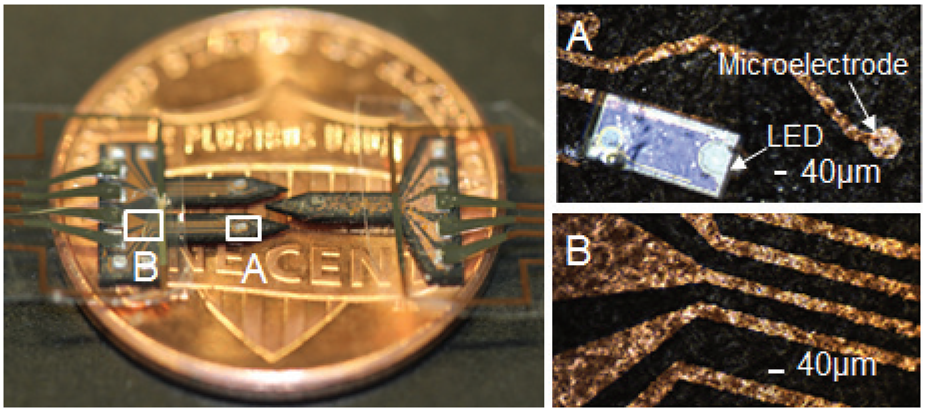
PRESS RELEASE

A hybrid neural interface optrode with a polycrystalline diamond heat spreader for optogenetics

April 4, 2016 — A polycrystalline diamond based neural interface optrode has been developed, which can minimize the joule heating effect generated by microscale light-emitting diodes during optical neuromodulation in the brain networks. The maximum temperature variation on the PCD probe for all applicable parameters is 1.3°C, which is 8~9 times lower than its counterparts, such as a polymer probe.



*Microfabricated single- and dual-shank polycrystalline diamond based optrodes: **A**. Integrated microscale light-emitting diode and recording microelectrode. **B**. Metal pads and interconnect wires.*

A team of researchers from Michigan State University (MSU) and Fraunhofer-Center for Coating and Diamond Technologies (Fraunhofer-CCD), East Lansing, MI have demonstrated a hybrid optrode combining small surface-mount light-emitting diodes (µLEDs) and microelectrodes on a polycrystalline diamond (PCD) substrate, for optogenetic stimulation and electrical recording of neural activity. Optogenetics is an emerging neuromodulation technology that uses light to manipulate the electrophysiological activity of genetically-target neurons. µLEDs are a promising light source considering their miniaturization, low power consumption, and simplicity of the integrated wireless power telemetry. However, localized Joule heat generated by µLEDs may cause tissue damage and bias the outcomes of optogenetic studies. Such concerns have not been addressed successfully yet.

PCD allows rapid dissipation of localized heat to a larger area to improve heat exchange with surrounding perfused tissues, and consequently the maximum temperature variance of the LED on a PCD substrate can be reduced by 8~9 times in comparison with a traditional polymer substrate (SU-8). The report appears in the March 2016 issue of the journal *TECHNOLOGY*.

"The temperature increase of our PCD probe is almost negligible, thanks to the superior thermal conductivity of PCD. This is critically important to the safety of implantable neural interface devices." says Associate Professor Wen Li, Ph.D., of the Michigan State University and Principal Investigator on the paper.

Additional co-authors of the TECHNOLOGY paper are Bin Fan, Ki-Yong Kwon, Ph.D., Arthur J. Weber, Ph.D. (from MSU), Robert Rechenberg and Michael F. Becker (from Fraunhofer-CCD).

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