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School of Biological and Health Systems Engineering

Next-generation thin-film implant materials for chronic neural interfacing

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Faculty Host: Sydney Schaefer

Abstract Implanted microelectrode arrays (MEAs) are pivotal in neuroscience, allowing for the recording of individual neural activities which aids in understanding neural circuits, neuron encoding, and neural signal decoding. In clinical settings, MEAs are crucial for intracranial brain-machine interfaces that help restore communication or movement in patients with conditions like locked-in syndrome or tetraplegia. As MEAs with higher channel counts become feasible for human clinical use, we face a complex balance between device performance and longevity. The smaller electrode sizes of these devices offer advantages, such as higher resolution and reduced immune reactions, thus improving functionality. However, these smaller electrodes also introduce challenges like reduced stimulation capacity, more complex surgical implantation, and possibly faster degradation of materials. In this presentation, I will share our latest developments in ceramic-based implants designed to navigate these performance challenges. I'll cover the difficulties in creating neural interfaces using amorphous silicon carbide and our strategy for a design that supports self-insertion, reduces insertion trauma, and minimizes tissue reaction, all while ensuring the long-term durability of the implant.

Biosketch Dr. Felix Deku holds the position of Betsy and Greg Hatton Assistant Professor in Neuroengineering at the Phil and Penny Knight Campus for Accelerating Scientific Impact, University of Oregon. He completed his undergraduate studies with first-class honors in molecular biology and biotechnology at the University of Cape Coast, Ghana. Dr. Deku obtained his master's and doctoral degrees in biomedical engineering from The University of Texas at Dallas. Previously, he led electrode engineering at Braingrade, a neurotechnology startup, and served as the Director of Microfabrication at Neuralink Corp, where he contributed to the development of high-density neural interfaces for paralyzed patients. Dr. Deku's research focuses on the development of chronically reliable neural interfaces for human applications. He is particularly interested in exploring the physiological impacts of neuromodulation and their connections to functional improvements. His laboratory specializes in engineering thin-film materials and devising innovative fabrication techniques to construct durable neural interfaces, while also investigating their integration with the nervous system, including the brain and peripheral nerves.