

Biodegradable Technologies for Medical and Environmental Applications

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Abstract:

Interfacing biological tissues with artificial implants for therapeutic purposes presents significant challenges. Devices must be miniaturized without compromising performance, and wireless operation is crucial to limit infection risks and improve patient comfort. In some applications, biodegradability offers an additional benefit by enabling implants to safely resorb after use. While biomedical MEMS have driven major advances, including cochlear implants and spinal cord stimulators, their roots in conventional semiconductor manufacturing make them not always suited to the soft and dynamic environment of the human body. Materials and fabrication approaches must therefore evolve to meet biomedical constraints. Soft, stretchable materials enhance mechanical compatibility and reduce inflammation, while biodegradable systems avoid secondary surgeries and minimize long-term tissue damage.

Our work aims to establish a new class of fully biodegradable, wireless MEMS integrating sensors, actuators, and electronics. We develop bioresorbable microsystems for wearable and organ-on-chip platforms, implants with integrated actuation and micropumping for peripheral nerve repair, ultrathin silicon-based devices for cardiac transplant monitoring, and soft robotic systems designed to support and restore cardiac function.

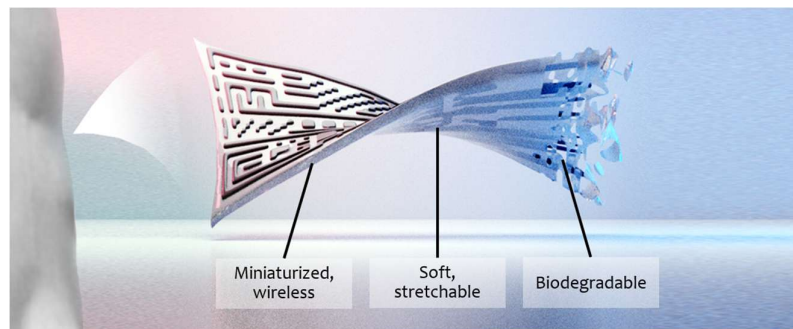


Fig. 1 - Biodegradable MEMS for medical applications

Keywords:

Biodegradable MEMS, Implantable medical devices, Wireless bioelectronics, Soft robotics, Bioresorbable materials

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