Tissue-like Transistors and Circuits for Stable Bioelectronics

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Conventional soft bioelectronic devices rely on bulky, rigid architectures and nonadaptive interconnects, leading to poor conformity with dynamic tissues, chronic compression, and rapid performance decay under mechanical deformation. Here, we integrate two complementary advances to overcome these limitations. First, we develop intrinsically stretchable and spontaneously self-healing transistors and circuits capable of autonomously repairing multiple damage modes (mechanical cuts, scratches, and delamination), sustaining stable operation over 20 000 redox cycles and 200 % strain, and allowing on-demand circuit reconfiguration for user-defined functionalities. These represent the first implantable, self-healing bioelectronic circuits, unlocking unprecedented resilience in both wearable and minimally invasive platforms . Second, we introduce ultrathin (~350 nm) organic electrochemical transistors (OECTs) that transition from a handled, rigid state to an ultra-soft, tissue-conformal form upon adhesion. This rigid-to-soft transformation ensures seamless, imperceptible integration with organ surfaces, minimizing foreign-body response and enabling high-fidelity, long-term bio-signal mapping. Together, these tissue-like electronics deliver transformative improvements in durability, biocompatibility, and functional stability, establishing a versatile foundation for next-generation closed-loop neuroprosthetic and diagnostic systems.