High-Adhesion Stretchable Electrode via Cross-Linking Intensified Electroless Deposition on Biomimetic Elastomeric Micropore Film

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Abstract

For the stretchable electrode, strong interface adhesion is the primary guarantee for long service life, and the maximization of tensile-limit with remarkable electrical stability can expand its usable scope. Here, a cost-effective strategy is proposed to fabricate a high-adhesion stretchable electrode. By modifying dopamine (DA) and functionalized silane on polydimethylsiloxane (PDMS) substrate in sequence before electroless deposition (ELD) process, super-high adhesion up to 3.1 MPa is achieved between PDMS substrate and silver layer, and the electrode exhibits extraordinary conductivity of 4.0 × 107 S/m. This process is also suitable for other common flexible substrates and metals. Moreover, inspired by the micro/nano structure on the surface of lotus leaf, biomimetic elastomeric micropore film (BEMF) with uniform distributed micropore is fabricated by the one-step soft lithography replication process. The electrode exhibits large tensile-limit exceeding 70% uniaxial tensile and superior electrical stability from 6.3 Ω to 11.5 Ω under 20% uniaxial tensile for more than 10000 cycles. This study seeks a promising method to manufacture stretchable electrode with high-adhesion, large tensile-limit and excellent electrical stability, showing great potential to detecting various biological signals including joint movement, surface electromyography (sEMG), etc.



Figure: a) Schematic illustration of the chemical bonding between the silver layer and BEMF.Example of a figure and its caption. b) The inspiration for structural design comes from the uniformly distributed micron-scale protrusions on the surface of the lotus leaf. c) Cross-section of the electrode. d) The adhesion test results of the samples. e) Resistance change under 20% uniaxial tensile strain with more than 10000 cycles.