INKJET-PRINTED ULTRATHIN STRETCHABLE ELECTRONICS FOR REAL-TIME AMBULATORY ECG MONITORING

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Abstract: In medical applications, there is a great interest in using wearable health monitoring systems to obtain physiological information because they are non-invasive and easy to use. Furthermore, the advancement of technology has allowed these electronics to be miniaturized. However, some wearable devices are still uncomfortable and rigid. To combat this, a new set of thin, soft, flexible skin-like electronics needs to be developed, which can significantly improve user comfort and the quality of signals. The objectives of this study were to characterize inkjet-printed skin-like electronics by optimizing inkjet printing parameters and surface energies of PI coated surface, which determine the drop size of silver nanoparticle (AgNP) inks. The optimal printing parameters were found the jetting voltage of 17 V with a drop spacing of 20 Âµm in the room temperature of 28Â°C. The PI coated surfaces were treated using carbon tetrafluoride (CF4) and oxygen gas (O2) to determine the degrees of hydrophobicity and hydrophilicity. Water contact angle measurements on PI substrates demonstrated 7.80Â°, 7.70Â°, and 7.20Â° for 30-second, 60-second, and 120-second O2 treatments, respectively and 78.4Â°, 88.6Â°, and 102.9Â° for 10-minute, 30-minute, and 60-minute CF4 treatments, respectively. Corresponding widths of inkjet-printed lines were 63.0 Âµm, 44.5 Âµm, and 41.7 Âµm for 10-minute, 30-minute, and 60-minute CF4 treatments, respectively. Finally, we were able to successfully inkjet-printed stretchable electrodes with 60-minute CF4 treatment, which is constructed with 60 Âµm line width for serpentine interconnects and 1 cm diameter of circular disks. In addition, inkjet-printed ultrathin stretchable electrodes were used to measure biopotentials to compare with biopotentials measured using traditional methods. Overall, creating a thinner, more comfortable, and cost-efficient inkjet-printed electrode for physiological signal monitoring can help improve the future of wearable technology and human performance.

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