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Facile fabrication of hybrid copper-fiber conductive features with enhanced durability and ultra-low sheet resistance for low-cost high-performance paper-based electronics

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The accelerating arrival of the Internet of Things (IoT) era creates huge demand for low-cost, high-performance paper electronics. However, fabricating highly conductive circuit on low-cost cellulose paper is challenging due to its high roughness and resolution loss caused by capillary effect. To address these challenges, we propose a scalable, cost-effective method to fabricate high-performance electronics on regular cellulose paper. Taking advantage of the unique porous structure of cellulose paper, we activate the three-dimensional electroless deposition of copper for fast generation of the hybrid copper-fiber highly conductive structure. Currently, the sheet resistance of most PE product is 50 mΩ/sq. With the technology mentioned above, 5 mΩ/sq (10 times better) can be easily achieved with low cost and high resolution (100 microns feature size). Thanks to its unique copper-fiber hybrid structure, both the physical and electrical properties are greatly enhanced for wider variety of applications. To demonstrate its promising application, a functional battery-free energy harvesting device and a high-performance planar antenna for RFID were fabricated and tested using the proposed method.

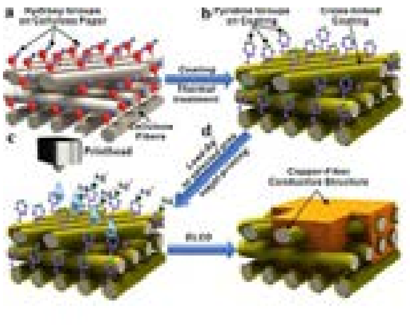

Figure 1. Fabrication process of a copper-fiber conductive structure on cellulose paper.

Biography

Tengyuan Zhang is currently a PhD Candidate of Mechanical & Materials Engineering in Western University, London, Ontario. His research explores printed flexible and stretchable electronics. Based on his research, he co-founded Nectro Inc. in 2015 with the goal of developing novel nano-materials and bringing them to people's life. He was awarded the Vanier Canada Graduate Scholarship in 2015 and won the Doctoral Excellence Research Award in 2016. Now, he looks to combine cutting-edge nanotechnology and advanced chemical/material science to find a robust, low-cost solution for manufacturing high-performance, high-resolution flexible and stretchable electronics.

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