Laterally combed carbon nanotube-based stretchable electrodes for wearable energy devices

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Carbon nanotubes (CNTs) have been regarded as the promising candidate materials for the soft electrodes of wearable energy devices due to their mechanical, electrical, and electrochemical properties. However, the electrical conductivity of the CNT networks is lower than that of metal foils, and complex mechanical deformations including bending and stretching, tend to destroy contacts between the CNTs and further lower the electrical conductivity of the electrodes. Here, we propose a novel fabrication method for stretchable electrodes based on laterally combed CNTs to address these issues. The laterally combed structure of vertically aligned CNT networks gives more contact points between the individual CNTs, consequently enhances electrical conductivity of the CNT networks. Even at an applied strain of ~100 %, these laterally combed CNTs maintain their contact points suppressing deterioration of the electrical conductivity. In addition, the ink jet printing technique enables to produce electrodes with optimized shapes for stretching. We finally demonstrated an integrated wearable energy supplying system that consists of energy harvesting and storage devices.