Title: Coaxially electrospun PANi-silver composite nanofibers for stretchable electrochromic devices

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Abstract:

Much effort has been devoted to developing flexible electronic devices. In particular, Indium tin oxide and fluorine doped tin oxide have been actively studied for transparent electrodes due to their inherent transparency and excellent conductivity due to their crystal structure properties. However, in addition to economic considerations, these materials have demonstrated limitations in development for flexible and stretchable devices due to increased resistance due to damage. In order to overcome these problems, efforts are being made to ensure flexibility, stretchability and conductivity by using other materials. Among them, silver is known to have high conductivity even at high transparency.

In this study, continuous silver nanofibers were fabricated by electrospinning, and subsequent reduction processes by ultra-visible (UV) light irradiation. The silver nanoparticles were formed on the surface of the nanofibers by the reduction of the silver precursor. The nanofibers were transparent and well conductive, but the contact of nanoparticles was easily separated in the deformed state, making it difficult to restore the conductivity. To improve electrical stability under mechanical deformation, nanoparticles were electrically sintered to form a continuous phase. The sintered silver nanofibers showed low resistance and excellent electrical stability. Bending and tensile tests were performed to evaluate the electrical properties. The resistance of the transparent nanofibers was almost unchanged in the bend test (at curvature radius 0.45 cm) for 3000 cycles and was 8% higher than 900 cycle stretching test (at 10% strain). Finally, PANi-silver composite nanofiber electrodes were fabricated by coaxial electrospinning for further applications.