

Metallized nanofiber networks based on kirigami structure for transparent and stretchable conductors

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In the past decade, stretchable electronics has been attracted intensive interest due to potential for next-generation wearable electronics. Therefore, a wide variety of stretchable devices has been successfully developed, including stretchable conductors, batteries, light emitting diodes, and so on. Among these devices, stretchable conductors are basic and indispensable components of stretchable electronic systems. Here, by borrowing a concept of kirigami (i.e., Japanese art of paper cutting), we have introduced transparent and stretchable conductors based on metallized nanofiber networks. To fabricate conductors, the metallized nanofibers were transferred onto kirigami-patterned elastic substrate. The conductors had a transmittance of ~80% and exhibited high stability with 20% increase in resistance at 60% strain, which was 4.5 times lower than that of the non-kirigami conductors. The resistance of the kirigami conductors increased by less than 20% after 1,000 stretching/releasing cycles with 60% strain, indicating excellent durability. The results demonstrated that kirigami patterns accommodate the strain while maintaining a conductive pathway, resulted from stress delocalization over preset cut points. The kirigami approach can be expanded to other applications to develop highly stretchable devices such as sensors and energy storage devices.