EFFECT OF CARBON NANOTUBES (CNTs) DISPERSITY IN AG/POLYDIMETHYLSILOXAN (PDMS) COMPOSITE CONDUCTORS

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ABSTRACT

Incorporating electrically conductive fillers into a polydimethylsiloxane (PDMS) matrix has emerged as the most common strategy for developing highly stretchable composite conductors.[1] It is well known that the uniform distribution of conductive fillers in viscous PDMS oligomers during fabrication substantially affects the electrical conductivity, processability, and reliability of the resulting composite conductors. However, systematic studies on enhancing the dispersion stability of the conductive fillers in viscous and oily PDMS matrices are still lacking. Here, we propose a novel rational design of Ag/PDMS composite conductors combined with surface-functionalized carbon nanotubes (CNTs) and methyl group-terminated PDMS.[2,3,4] First, we investigated the relationship between the different types of CNTs and polar solvents that affect the dispersity of CNTs in the resulting conductive composites. Next, we examined the role of methyl group-terminated PDMS as a mediator between Ag, CNT, and PDMS, resulting in homogenously hybridized Ag/CNT fillers within the PDMS matrix. The resulting Ag/CNT/PDMS composite exhibited a metal-like initial electrical resistance of 1.0 ohm/sq and maintained its electrical resistance over 3,000 stretching cycles. This work provides new chemical insights and guidelines for preparing conductive composites.

REFERENCES

1. Larmagnac, A.; Eggenberger, S.; Janossy, H.; Vörös, J. Stretchable electronics based on Ag-PDMS composites. *Scientific reports* **2014**, *4*, 1-7.

2. Deborah, M.; Jawahar, A.; Mathavan, T.; Dhas, M. K.; Benial, A. M. F. Spectroscopic studies on sidewall carboxylic acid functionalization of multi-walled carbon nanotubes with valine. *Spectrochimica Acta Part A: Molecular and Biomolecular Spectroscopy* **2015**, *139*, 138-144.

3. Kim, J. H.; Hwang, J.; Hwang, H. R.; Kim, H. S.; Lee, J. H.; Seo, J.; Shin, U. S.; Lee, S. Simple and cost-effective method of highly conductive and elastic carbon nanotube/polydimethylsiloxane composite for wearable electronics. *Scientific reports* **2018**, *8*, 1375.

4. Zhang, J.; Gao, L. Dispersion of multiwall carbon nanotubes by sodium dodecyl sulfate for preparation of modified electrodes toward detecting hydrogen peroxide. *Mater Lett* **2007**, *61*, 3571-3574.