Textile Sensor based on Graphene

Joana Tavares
Ismael Domingos and Helena Alves
University of Aveiro, Campus Universitário de Santiago, Universidade de Aveiro, 3810-193, Aveiro, Portugal
j.silvatavares@ua.pt

In textile electronics, it is possible to put electronic devices in everyday life objects, such as clothes, home textiles or other textiles objects. However, to develop this technology it is required advances in materials and manufacturing processes, particularly combine flexibility, electrical properties of semiconductors and metals with solution and low temperature processing [1]. Graphene is a two-dimensional material, with incredible properties such as: flexibility, transparency, high and electrical conductivity [2]. Therefore, graphene is a strong candidate material for textile electronics, either as electrode or sensor. A conductive textile coated with graphene exhibited conductivity of $8 \cdot 10^{-3}$ Ω cm^{-1} and sheet resistance lower than 1 Ω sq^{-1}, while maintaining its mechanical properties [3, 4]. Graphene also has a great sensitivity capability, capable of biomolecules and gases detection [5].
In this work we present the development of textile embedded sensor of humidity and temperature based on Few-Layer Graphene (FLG). The coating of textiles is done through solution. The solution is prepared through graphene's exfoliation by blend shearing and it was used Raman spectroscopy to verify the quality of graphene solution. This solution was deposited directly on top of the clean textile samples, through solvent evaporation at controlled temperature. Observation at Scanning Electron Microscope (SEM) was, performed to make morphological analysis. As it can be seen in Fig. 1, the FLG solution does not alters the textile fibers, and adheres strongly to the fiber, making textile conductive. Temperature and humidity tests revealed a dependence with electrical conductivity of the samples. Finally, the samples were submitted to relative humidity and temperature tests, in a controlled environment, provided by a climatic chamber. It is observed a strong relation between both, humidity and temperature, with the electrical behaviour of the graphene coated textile samples. These results indicate that resistive sensors based on graphene embedded textiles can be used for environmental and biological monitoring applications.

REFERENCES

[1] Kim, S. J., Choi, K., Lee, B., Kim, Y., Hong, B. H., Annual Review of Materials Research, 45, (2015) 63-84.
[2] Novoselov, K. S., Fal, V. I., Colombo, L., Gellert, P. R., Schwab, M. G., Kim, K., Nature, 490 (7419), (2012) 192-200.
[3] Neves, A. I. S., Bointon, T. H., Melo, L. V., Russo, S., De Schrijver, I., Craciun, M. F., Alves, H., Scientific Reports, 5, (2015) 9866.
[4] Neves, A. I., Rodrigues, D. P., De Sanctis, A., Alonso, E. T., Pereira, M. S., Amaral, V. S., Craciun, M. F., Scientific reports, 7(1), (2017), 4250.
[5] Zhu, Y., Murali, S., Cai, W., Li, X., Suk, J. W., Potts, J. R., Ruoff, R. S, Advanced materials, 22(35), (2010) 3906-3924.

FIGURES

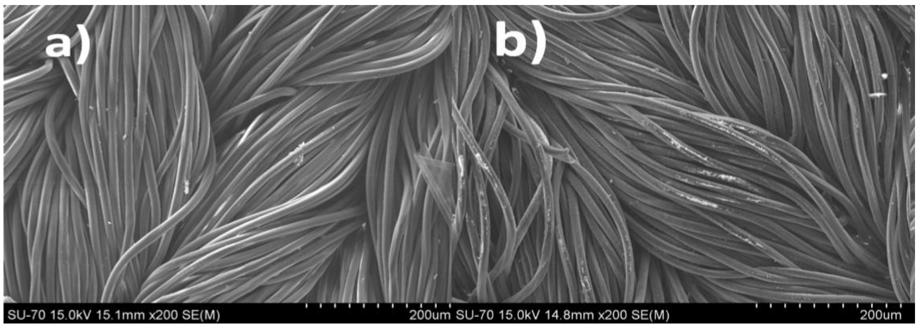

Figure 1: Textile sample: a) before and b) after FLG deposition, SEM image.