Thermally Conductive Textiles impregnated with Hybrid Nanocomposites based on Ag Nanoparticles Decorated Reduced Graphene Oxide

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Smart wearable textiles, able to grant personal thermal comfort, have attracted increasing attention as innovative solutions to improve individual psychological and physiological welfare in working environment [1]. In indoor environment, advanced passive cooling textiles, able to dissipate human body heat by convection, offer the possibility to decrease consumption of energy intensive ventilation and air condition systems, thus beneficially impacting environmental and economic sustainability [1]. In this work, preparation and characterization of cotton textiles, impregnated with thermally conductive hybrid nanocomposites formed of Reduced Graphene Oxide (RGO) and Ag nanoparticles (NPs), are reported towards the achievement of original wearable passive personal cooling devices. RGO has been exfoliated and surface functionalized with histidine (His) (Fig.1A), a biocompatible linker able to bind the RGO basal plane via π-π interactions [2] and the cotton surface via hydrogen interactions, while interacting with the Ag NP surface by means of coordination bonds. Ag NPs have been *in situ* synthesized onto His-RGO impregnated textiles by reduction of the silver nitrate ($AgNO_3$) precursor both under UV-light irradiation (Fig.1B-C) and by sodium borohydride ($NaBH_4$) reducing agent addition [3]. Samples of the His-RGO/Ag NP impregnated textiles have been prepared by varying experimental parameters, as pH of the His solution exfoliating RGO, His:RGO w:w ratio, RGO and $AgNO_3$ concentration, and $AgNO_3$ reduction conditions, and comprehensively investigated by UV-Vis absorption, Raman, XPS, SEM-EDS, and thermal conductivity measurements, in order to define the most suited conditions for obtaining highly thermally conductive textiles.

References

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Figures

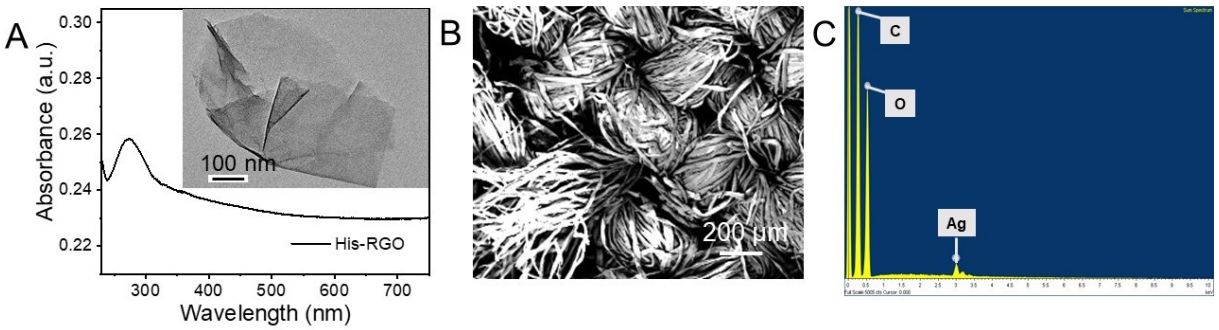

Figure 1: (A) UV-Vis absorption spectrum of 0.04 mg mL^{-1} His-RGO in MilliQ water and corresponding TEM image (in the inset). (B) SEM image and (C) EDS spectrum (0-20 keV) of His-RGO/Ag NP impregnated textiles achieved by $AgNO_3$ reduction under UV-light irradiation (254 nm).

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