A low cost and rapid approach for producing a conductive graphene oxide-based polycaprolactone composite

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Since the discovery of graphene, diverse graphene-based materials have been extensively studied, for many different applications. One of the most relevant areas aims at obtaining new polymeric composites, in order to strategically unite the unique advantages of graphene, such as its high electrical conductivity, incorporating it to the polymeric matrix [1,2]. However, one of the main challenges in this field is to consolidate a low cost, nontoxic and large scale manufacturing route. This project proposes a new manufacturing route to produce a reduced graphene oxide (rGO) based polycaprolactone (PCL) fibrous membranes. PCL is a biodegradable and biocompatible polymer commonly used in implants and tissue engineering. The GO was synthesized by the modified Hummers' method, being dip-coated on the PCL membranes produced via rotary jet spinning [3], a low cost and high production technique. The obtained PCL-GO presented a poor electrical performance, with high electrical resistance (2-3 MΩ). Then, a thermal reduction of GO was studied, using a hot plate under ambient condition, which is a fast and green reduction route, in order to evaluate the effect of the reduction time and the temperature in terms of electrical resistance variation. The samples were characterized through the X-Ray diffraction, Raman and XPS spectroscopies, thermogravimetric analysis, scanning electron microscopy, and four-point probe for the electrical measurements. The overview of the manufacturing process is shown in the figure 1. The electrical resistance dropped up to 3 orders of magnitude. The results are promising for applying this composite as a biosensor or a scaffold.

References

[1] Ishwarchand W, Sarakar G, Swain B, Polymer Bulletin (2021) 1-17.
[2] Smith A. T., LaChance A. M., Zheng S., Liu B., Sun L., Nano Materials Science, 1 (2019) 31-47.
[3] Rogalski J., Bastiaansen C., Peijs T., Fibers, 6 (2018) 37-49.

Figures

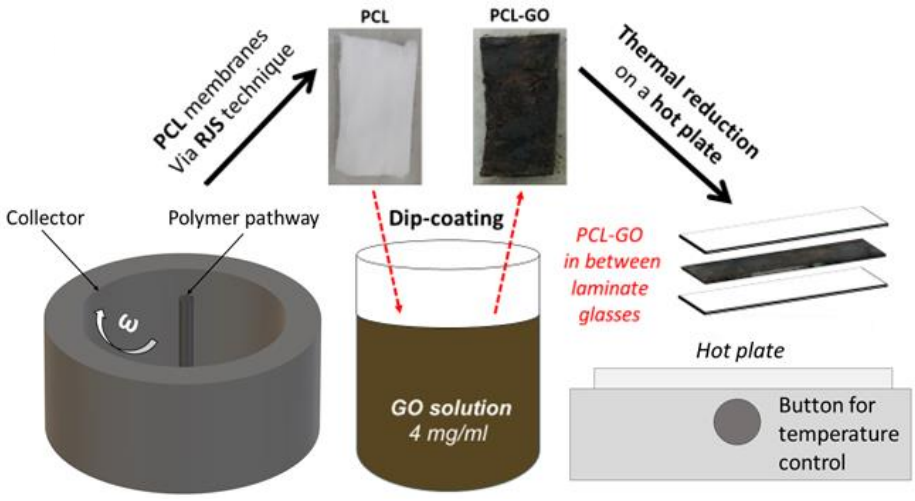

Figure 1: Manufacturing process overview