Northumbria University NEWCASTLE

AMT

Self-funded PhD opportunities at the Advanced Manufacturing Technology (**AMT**) research group, Department of Mechanical and Construction Engineering, Faculty of Engineering and Environment, Northumbria University, Newcastle Upon Tyne, UK

Project Title:

Development of novel graphene hybrid-supercapacitors

Project Description [300 words]
(Please include links to further web page information in this section, if needed)

Within this proposal, the potential PhD candidate will develop a supercapacitor film-based graphene (GSCf) as potential application for electrical vehicle's battery replacement. The GSCf is exceptionally thin and strong and releases energy very quickly needed for a high acceleration rate.

He/She will work to increase the amount of energy to be released as a candidate for mass-storage batteries with charging time of a few minutes. He/She will investigate the how these GSCf will be integrated into several places areas of the vehicle structure to maximise the energy storage, and significantly reducing the vehicle weight by excluding the traditional battery form the structural design.

Hence, he/she will develop novel metal oxide anchored nanocarbon graphene foam nanoarchitectures that improve the performance of supercapacitors, a development that could mean faster acceleration in electric vehicles and longer battery life in portable electronics. He/She will also explore how nanoarchitectures in term of morphology, particle size, surface area, and pore size/distribution define energy and power performance.

Modelling, design characterisation, fabrication and testing of the new GSCf will be carried out.

Faculty: Engineering and Environment

Department

Mechanical and Construction Engineering

Principal Supervisor

Prof Ahmed Elmarakbi

Recent publications by supervisors relevant to this project

1. **Elmarakbi, A.** and Azoti, W. (2018) "State of the Art of Graphene Lightweighting Nanocomposites for Automotive Applications" Experimental characterization, predictive mechanical and thermal modeling of nanostructures and their polymer composites. Edited by Francesco Marotti De Sciarra and Pietro Russo. Elsevier, Oxford, United Kingdom, Chapter 1, pp. 1-23, ISBN: 978-0-323-48061-1

2. **Elmarakbi, A.** and Azoti, W. (2018) "Mechanical Prediction of Graphene-based Polymer Nanocomposites for Energy-Efficient and Safe Vehicles" Experimental characterization, predictive mechanical and thermal modeling of nanostructures and their polymer composites. Edited by Francesco Marotti De Sciarra and Pietro Russo. Elsevier, Oxford, United Kingdom, Chapter 4, pp. 159-177, ISBN: 978-0-323-48061-1

3. Hassen, D., Shenashen, M., El-Safty, A., Elmarakbi, A. and El-Safty, S. (2018) " Anisotropic N-Graphene-Diffused Co3O4 Nanocrystals with Dense Upper-Zone Top-on-Plane Exposure Facets as Effective ORR Electrocatalysts" Nature Scientific Reports; 8, 3740, pp.1-14.

4. Selim, M., **Elmarakbi, A.,** Azzam, A., Shenashen, M., EL-Saeed, A. and El-Safty, S. (2018) "Eco-Friendly Design of Superhydrophobic Nano-Magnetite/Silicone Composites for Marine Foul-Release Paints" Progress in Organic Coatings, Vol. 116, No. 30, pp. 21-34.

5. Basso, M., Azoti, W., Elmarakbi, H. and and Elmarakbi, A. (2018) "Multiscale simulation of the intralaminar failure of graphene nanoplatelets reinforced fibers laminate composite materials" Journal of Applied Polymer Science. (In press)

6. Selim, M., Shenashen, M., Fatthallah, N., **Elmarakbi, A.** and El-Safty, S. (2017) "In Situ Fabrication of One-Dimensional-Based Lotus-Like Silicone/Y–Al2O3 Nanocomposites for Marine Fouling Release Coatings" ChemistrySelect, Vol. 2, No. 30, pp. 9691-9700.

7. Selim, M.S., Shenashena, M., **Elmarakbi, A.**, EL-Saeed, A., Selim, M.M., and El-Safty, S. (2017) "Sunflower oil-based Hyperbranched Alkyd/Spherical ZnO Nanocomposite Modeling for Mechanical and Anticorrosive Applications. RSC Advances. Vol. 7, No. 35, pp. 21796-21808.

8. Selim, M., El-Safty, S., Sakai. M., Higazy, S., Shenashen, M., Isago, H., and **Elmarakbi, A.** (2017) "Recent Progress in Marine Foul-Release Polymeric Nanocomposite Coatings" Progress in Materials Science. Vol. 87, pp.1–32.

Eligibility and How to Apply

Qualification

Applications are invited from exceptional candidates who have a good first or upper second class degree (or equivalent) in engineering, materials science. Students who are not UK/EU residents are eligible to apply, provided they hold the relevant academic qualifications, together with an IELTS score of at least 6.5. This project is well suited to motivated and hard-working candidates with a keen interest in design, materials and manufacturing. The applicant should have excellent communication skills including proven ability to write in English.

For more information and informal enquiries please contact Dr Zi Lin
ahmed.elmarakbi@northumbria.ac.uk

Deadline for applications:

- 1st December for March (following year) start; 1st June for October (same year) start.

Start Date: March and October of each year