Department	School of Engineering and the Built Environment
Supervisors	Dr Zhilun Lu, Prof Islam Shyha, Dr Dongyang Sun
Project Title	Renewable and flexible dielectric materials for sustainable electronics

PROJECT DESCRIPTION

Electrostatic energy storage based on dielectric materials is a critical component of sophisticated electronics and high-power electrical systems [1]. As with capacitors, dielectrics aid in charge retention and are critical energy storage components [2]. Due to the growing demands for lightweight, flexibility, and miniaturisation in electronics, polymer-based dielectric materials have garnered considerable interest in the field of energy storage. However, dielectric polymers are now largely thermoplastic, nonbiodegradable, and nonrenewable. Natural and green dielectric materials are viewed as a vital and urgent element in alleviating the current energy and environmental crises.

In comparison to the traditional polymers, cellulose is the most abundant natural polymer on the planet, is renewable, environmentally friendly, and biodegradable, and serves as an excellent matrix for flexible dielectric films [3]. Therefore, cellulose is one of the most promising green dielectric materials for the sustainable development of modern electronics.

In this study, cellulose nanofibrils from an aquatic weed, water hyacinth (WH), will be extracted. And flexible nanocellulose-based dielectric films will be developed. WH is an invasive aquatic plant that has caused conservation issues in a number of countries. The extraction process is based on well-established research into nanocellulose. This project will not only convert useless weed into a valuable product but will also help reduce the cost of dielectric films.

Academic qualifications

A first degree (at least a 2.1) ideally in Materials, Chemistry with a good fundamental knowledge of materials.

English language requirement

IELTS score must be at least 6.5 (with not less than 6.0 in each of the four components). Other, equivalent qualifications will be accepted. [Full details of the University's policy] are available online.

Essential attributes:

- Experience of fundamental flexible materials
- Competent in basic laboratory skills, especially cellulose extraction
- Knowledge of materials sience and engineering, chemistry
- Good written and oral communication skills
- Strong motivation, with evidence of independent research skills relevant to the project
- Good time management

Desirable attributes:

Postgraduate training in Materials Science

Indicative Bibliography	[1] H. Pan, et al., Science 365 (6453), 578-582. [2] H. Pan, et al., Science 374 (6563), 100-104. [3] Q. Guo, et al., Journal of Energy Chemistry 51 (2020) 342-361.
Funding notes	Self-funded students only
Enquiries	For informal enquiries about this PhD project, please contact For informal enquiries about this PhD project, please contact Z.Lu@Napier.ac.uk

Web page	https://www.napier.ac.uk/research-and-innovation/research-degrees/application-process