

2023_02_Innovative recycling technique for achieving zero pollution wind power

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(a) Motivation for the project

Recycling waste wind turbine blades remains one of the biggest challenges in the wind energy sector, especially for the UK who is a global leader in offshore wind. This challenge becomes even more urgent now with only 7 years to go before meeting the wind industry's ambitious target of producing zero waste wind power by 2030. Unfortunately, there is no effective recycling method available, and the waste blades are going into landfill or being incinerated causing environmental issues and wasting valuable resources. This project will solve this urgent challenge by developing a new method of recycling waste wind blades for making low carbon concrete (WINDCRETE). This method will directly impact wind energy and construction industries, by enhancing the sustainability of wind power while decarbonising concrete. It helps solving the pollution issue in wind industry, at the same time provide a solution to CO₂ emission in concrete industry.

(b) Context and background

This project strategically aligns well with the research area of Pollution, Waste and Resources in the NERC remit. This project aims to solve the pollution issue in wind industry due to waste blades which can be turned into valuable resources in concrete industry.

(c) Objectives and methodology

The student will contribute to part of a large project, and will be mentored by senior PhD students and one research associate. In particular, the student will carry out experimental testing, data collection to help with the following two research objectives.

OBJ1 Develop a new thermal-chemical-mechanical framework for maximizing pozzolanic reactivity of the blade powders. This is the key to accelerate the blade powder hydration in the concrete. Informed by the thermodynamic and MD modelling, a new framework will be developed and optimized to treat the powders using a series of thermal, chemical and mechanical techniques to maximize the reactivity.

OBJ2 Implement the framework to unravel the mechanism of the short- and long-term strength development, and quantify the durability of concrete made with recycled blade powders. The aim is to optimize the cement replacement ratio with the recycled blade powders. This is made possible by gaining insights into the strength development with time of concrete of various cement replacement ratios. Ionic transportation will be

analysed to quantify concrete durability to ensure sustainable infrastructure applications.

Project length: 10 weeks