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WEAMEC

Research, Education & Innovation in Pays de la Loire FOR MARINE ENERGY

OPIN Workshop

Advanced Materials and Manufacturing (Composite focus)

12/11/19, Nantes

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Brian Mannion

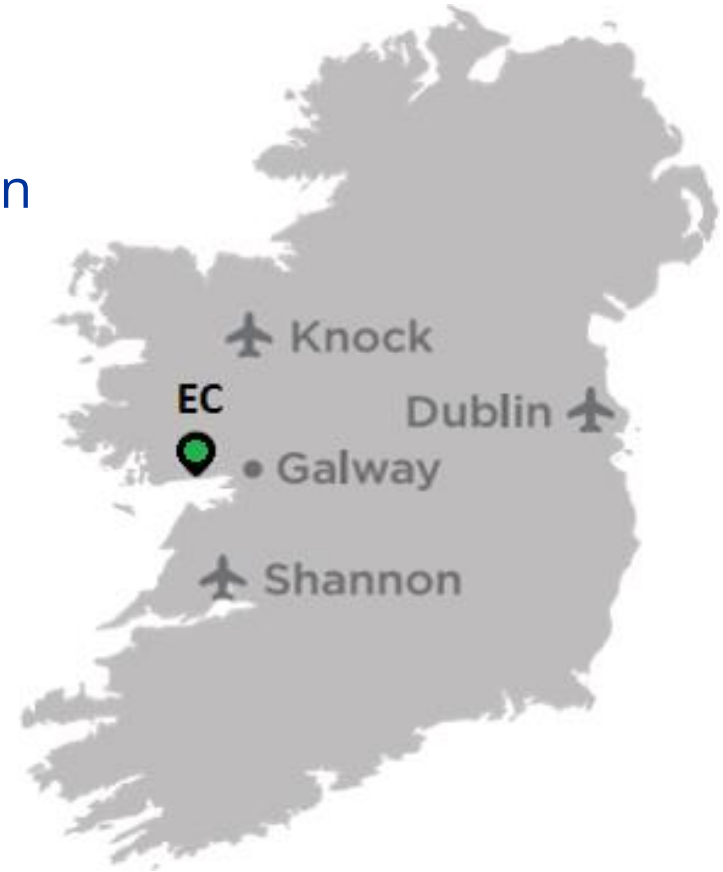
on behalf of Conor Glennon

Eirecomposites

Applications and needs from the industrial sector

Overview - About Us

- Located in Galway, Ireland and Founded in 1997; 60 staff
- Composites Design, Manufacturing & Testing
- R&D focused on Aerospace & Renewable Energy
- AS/EN 9100 and NADCAP approved

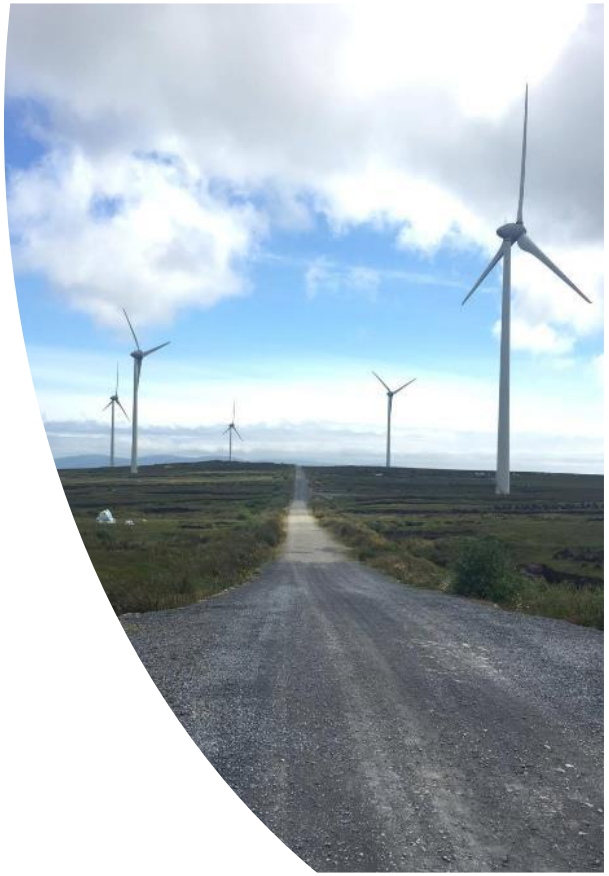


Overview - Equipment

- 6,000 m^2 facility in Galway
- Autoclave 1: 250 °C, 10 bar 2.5 m Ø x 6 m
- Autoclave 2: 450 °C, 10 bar 1.5 m Ø x 3 m
- 6 m CNC Machine
- NDT C-Scan
- State of the art 660 kW gas-fired oven
- Calibrated oven (16 m x 3 m x 4 m)
- Thermoplastic compatible press platen
- Liquid processing equipment
- Paint booth

Renewable Energy Overview

- Challenges in Marine Applications
- Production
- Powder Epoxy Technology
- PowderBlade – Powder epoxy technology
- LEAPWind – Leading edge protection



Challenges for Composite use in Marine Applications

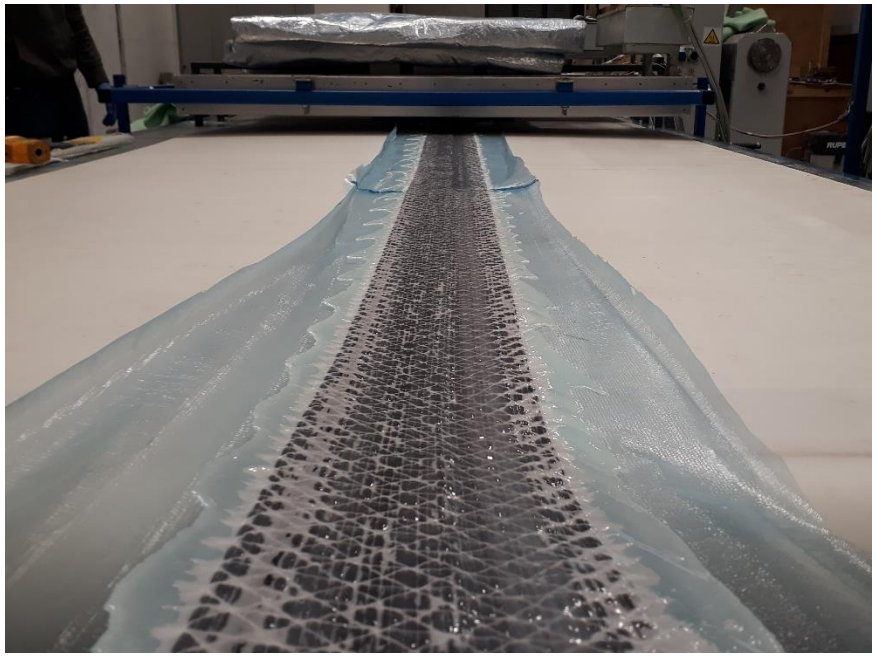
- High Loads Requires Thick Sections
  - Difficult to infuse
  - Potential dry spots and poor quality
  - Powder epoxy or prepregs address this
- Tidal Blades are Shorter
  - Faster changes in geometry
  - Difficult to manufacture
- Potential Erosion/Cavitation Damage
  - Marine environment causes erosion of blades and floating structures
- Potential Damage by Water Uptake
  - Water uptake reduces performance of composites
  - Can be mitigated by coatings
- Limited Data on Degradation
  - Trials can be done by artificially aging samples in heated Seawater
  - Limited data on fatigue performance in seawater

Production

- ÉireComposites blades are made using the company's patented MechTool®, which allows high-temperature processing of materials
- **13 m Blades –** for the Vestas V27 machine from glass fibre and epoxy resin
- **14 m Blades –** for a derivative of the 225 kW Vestas V29
- **SDWinds Blades –** Glass-fibre reinforced polypropylene (Twintex) thermoplastic wind turbine blades for 6 kW and 15 kW Kingspan machines

Powder Epoxy Technology

- Powder-epoxy resins have properties that make them suitable as a matrix for the production of composite wind turbine blades
- Technology has been demonstrated on 14 m wind blades
- ÉireComposites has developed a production line specifically for powder epoxy prepreg.



Powder Epoxy Advantages

- Excellent fibre wet-out, even in thick sections
- Reduction in post-processing requirements
- Reduction in material wastage and overall part cost
- Reduction in transportation and storage costs

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POWDERBLADE

ÉIRECOMPOSITES

- PowderBlade is a €2.7m Horizon 2020 project to develop large wind blades.
- The project is based on a novel process for manufacturing blades from powder epoxy
- Project focuses on blade roots and spar caps
- Project partners are: ÉireComposites, Suzlon, WestBIC & the University of Edinburgh

SUZLON WestBIC THE UNIVERSITY OF EDINBURGH UNIVERSITY of EDINBURGH

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POWDERBLADE

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Objectives:

- Design and manufacture a carbon fibre spar and glass fibre root for a full-scale hybrid blade
- Develop a computational model of the cure cycle
- Design and test a torsion box representative of a full-scale wind blade
- Reduce cycle time for blade production
- Commercialise the composite manufacturing technology for large wind blades

SUZLON

WestBIC

THE UNIVERSITY OF EDINBURGH
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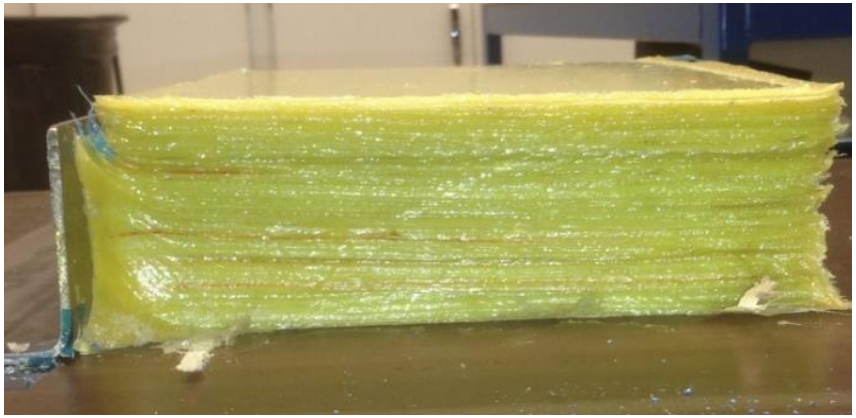
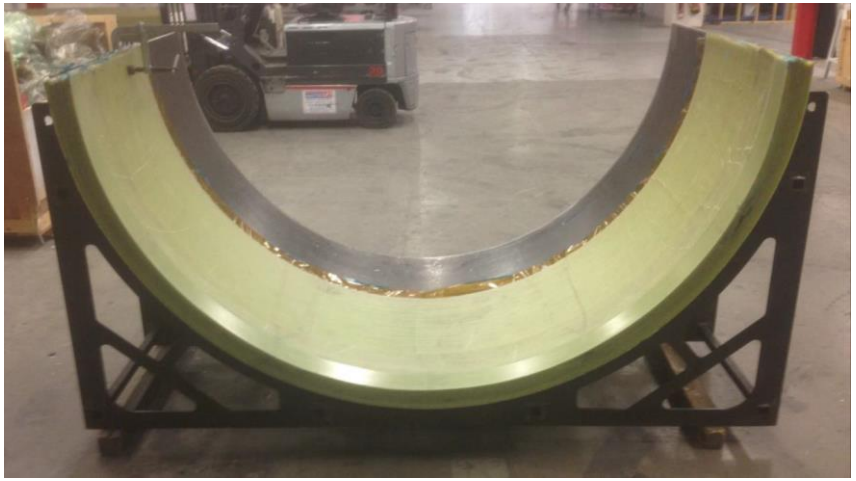
Results: Glass Fibre Root

- Laminates manufactured and tested to establish mechanical and fatigue properties
- Several trials performed on 96-ply thick laminates – excellent wet-out achieved
- Temperature probes used to validated numerical model
- Blade root sections manufactured for a 54 m wind turbine blade





Results: Carbon Fibre Spars

- Laminates manufactured and tested to establish mechanical and fatigue properties
- First 13 m demonstrators manufactured but problems found with fibre-alignment
- Second 13 m demonstrators manufactured and fibre-alignment issue resolved
- Work ongoing to compare powder epoxy costs as to alternative manufacturing methods

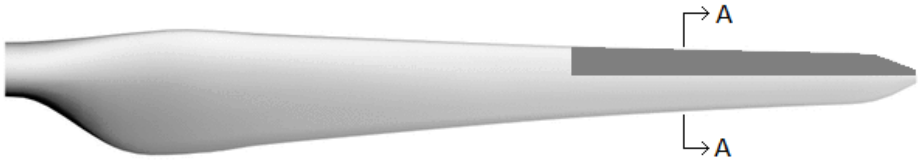
LEAPWind

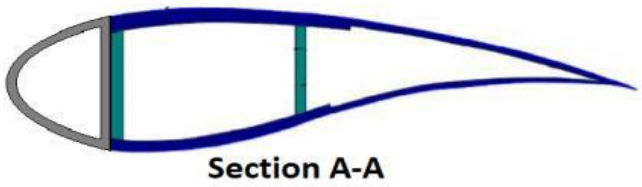
- LEAPWind is a €1m Horizon 2020 project to develop leading edge protection for blades
- **L**eading **E**dge **A**dvanced **P**rotection using novel thermoplastic materials and processes for offshore wind turbines
- Aim is to produce a new commercial leading-edge blade component using advanced composite materials and innovative manufacturing processes
- Project partners are: ÉireComposites, Suzlon, National University of Ireland, Galway

LEAPWind

Objectives:

- Develop a commercial process for manufacturing leading edge wind blade components using EireComposites' powder epoxy technology
- Perform structural and rain erosion testing to de-risk the technology
- Perform full-scale operational tests on existing wind turbine
- Introduce the novel leading edge blade component to offshore wind energy market
- Lower LCoE by 10 % (by decreasing risk, increasing productivity and reducing maintenance costs)





LEAPWind

Results:

- Down-selection of materials for erosion prevention
- Down-selection of adhesives
- Manufacture of laminates for rain erosion testing (RET)
- Definition of RET test matrix
- Manufacture of 1 m demonstrator
- Manufacture of 13 m demonstrator

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Thank you!

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