NASA Langley's

Out of Autoclave Wind Turbine Blade Manufacturing Method

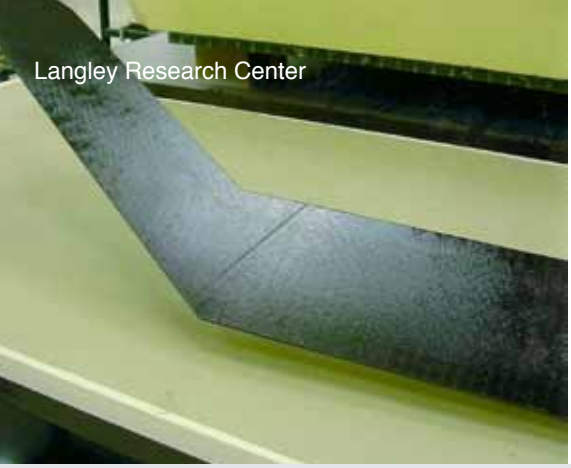
Assembly supports composite laminate materials during roll press processing at room temperature

As more countries commit to wind power, development of wind turbines is increasing. A fixture that NASA has used to produce large structural parts for unmanned aerial vehicles can also benefit wind turbine blade manufacturing. NASA's new technology addresses some cost and manufacturability barriers with current composite wind turbine blade processing. The fixture includes flexible vacuum bagging to contain the raw material lay-up as it is roll-pressed into a gently contoured blade. The process is an alternative to hand tooling and autoclaving, and produces parts with quality close to those processed under high-temperature and high-pressure environments. It can use a variety of reinforcement fibers and is not dependent on matrix viscosity to achieve part wet-out, even on thick laminations. The fixture and process are applicable to low-volume production but have potential for adaptation to automated high rate production. NASA has obtained a patent on the assembly, and it seeks an industry partner to commercialize the technology for wind turbines.

Benefits

- Potential portability – The simplified tooling assembly may be trucked to enable blade manufacturing and repair in the field.
- No human-in-the-loop – Process may be amenable to automation.
- Reduced capital costs – Tooling costs are much less than those for traditional manufacturing techniques.
- Simplified processing – Room-temperature processing eliminates the need for large costly chambers.
- Improved strength for larger parts – Can be scaled to make larger parts than possible with an autoclave..
- One-piece near net laminate construction reduces the number of joints associated with multiple smaller autoclave-processed components that require secondary operations requiring fasteners or bonding.
- Potential for in the bag heating to facilitate reduced cycle times.

partnership opportunity



The Technology

The technology is an assembly to support the fabrication of composite laminate materials during roll press processing. It is an alternative to hand tooling and autoclave processing. As shown in Figure 1, two perforated films cover the mix of uncured resin and fibers. A gas permeable bag surrounds and seals the mixture and the films, helping to distribute a vacuum. Plates press the mixture from both sides as part of the roll press process. Starting with uncured carbon fiber and resin, the components are assembled and put through a press process at room temperature and pressure. The assembly and process has been used to make large two- and three-dimensional (constant thickness with steps downs) parts. Tapered laminates like those needed for gently contoured wind turbine blades are possible with the process.

USPTO 7,871,682

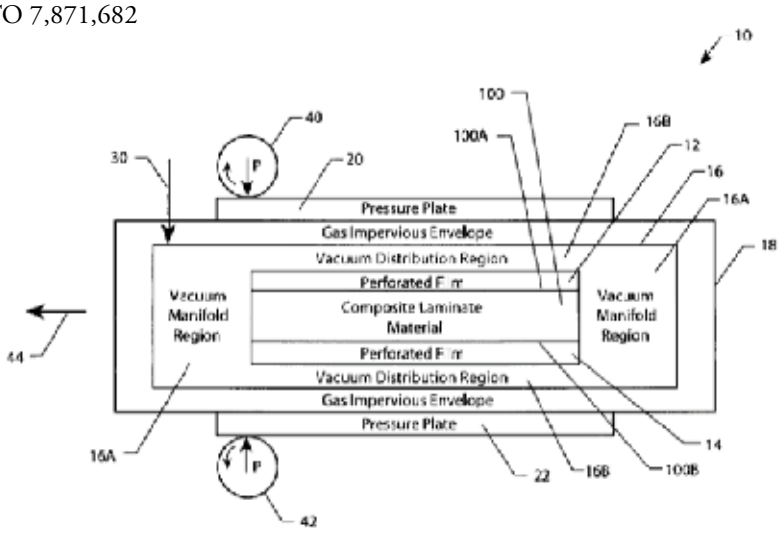


Figure 1: A schematic shows how the flexible vacuum bagging contains the raw material for roll-pressing.

Figure 2: The NASA team shows a roll-pressed composite wing made with the fixture.

Applications

- Wind Power – lower-cost, locally manufactured blades
- Infrastructure – bridges, buildings
- Marine vessels and structures.

For More Information

If your company is interested in licensing or joint development opportunities associated with this technology, or if you would like additional information on partnering with NASA, please contact:

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