hollow structures may be limited, thereby limiting available characteristics of the resulting hollow structures.

[0004] The disclosed system is directed to overcoming one or more of the problems set forth above and/or other problems of the prior art.

Summary

[0005] The present disclosure is directed to a head for a continuous manufacturing system. The head may include a housing, a fiber guide rotatably disposed at least partially inside the housing, and a diverter at an end of the housing. The diverter may be configured to divert radially outward a matrix-coated fiber passing through the fiber guide.

[0006] The present disclosure is directed to a system for continuously manufacturing a hollow structure. The system may include a support capable of moving in a plurality of directions, a drive having at least one rotating shaft, and a head coupled to the support via the drive. The head may be powered by the at least one rotating shaft to discharge a continuous flow of matrix-coated fibers during movement of the support. The head may include a housing, a first fiber guide disposed at least partially inside the housing and coupled to the at least one rotating shaft, and a second fiber guide disposed at least partially inside the first fiber guide and coupled to the at least one rotating shaft. The head may further include a diverter at least partially inside the second fiber guide at an end of the housing opposite the drive. The diverter may be configured to divert radially outward matrix-coated fibers passing through the first and second fiber guides.

[0006a] In one aspect, the present disclosure is directed to a method of continuously manufacturing a composite hollow structure, comprising: continuously coating fibers with a matrix to form matrix-coated fibers; revolving the matrix-coated fibers about a non-fiber axis; diverting the matrix-coated fibers radially outward away from the non-fiber axis; dynamically adjusting a trajectory of the non-fiber axis of the composite hollow structure; and curing the matrix-coated fibers to maintain the adjusted trajectory of the composite hollow structure.

[0006b] In another aspect, the present disclosure is directed to a method of continuously manufacturing a composite hollow structure, comprising: continuously coating fibers with a matrix to form matrix-coated fibers; revolving a first subset of the matrix-coated fibers in a first direction; and revolving a second subset of the matrix-coated fibers in a second direction opposite the first; diverting the first and second subsets of the matrix-coated fibers radially outward away from a non-fiber axis;

pressing the first subset of the matrix-coated fibers against the second subset of the matrix-coated fibers; dynamically adjusting revolving of the first and second subsets of the matrix-coated fibers during manufacturing of the composite hollow structure; curing the first and second subsets of the matrix-coated fibers to retain the adjusted first and second subsets of the matrix coated fibers; and mechanically pinching the first and second subsets of the matrix-coated fibers prior to curing the first and second subsets of the matrix-coated fibers in order to fix a length of the composite hollow structure.

Brief Description of the Drawings

[0007] Figs. 1 and 2 are diagrammatic illustrations of exemplary disclosed manufacturing systems;

[0008] Fig. 3 is cross-sectional illustration of an exemplary disclosed drive and head that may be used in conjunction with the manufacturing systems of Figs. 1 and 2;

[0009] Fig. 4 is an exploded view illustration of the head of Fig. 3;

[0010] Fig. 5 is a perspective illustration of an exemplary disclosed shield that may be connected to the head of Figs. 3 and 4; and

Claims

What is claimed is:

1. A method of continuously manufacturing a composite hollow structure, comprising:
continuously coating fibers with a matrix to form matrix-coated fibers;
revolving the matrix-coated fibers about a non-fiber axis;
diverting the matrix-coated fibers radially outward away from the non-fiber axis; dynamically adjusting a trajectory of the non-fiber axis of the composite hollow structure; and
curing the matrix-coated fibers to maintain the adjusted trajectory of the composite hollow structure.

2. The method of claim 1, wherein revolving matrix-coated fibers includes: revolving a first subset of the matrix-coated fibers in a first direction; and revolving a second subset of the matrix-coated fibers in a second direction opposite the first direction.

3. The method of claim 2, wherein revolving the first and second subsets of matrix-coated fibers includes synchronously oscillating between the first and second directions.

4. The method of claim 2, wherein revolving the first and second subsets of matrix-coated fibers includes revolving the first and second subsets of matrix-coated fibers through a range of up to 180°.

5. The method of claim 4, wherein revolving the first and second subsets of matrix-coated fibers includes revolving the first and second subsets of matrix-coated fibers through a range of about 15° to about 30°.

6. The method of claim 2, wherein revolving the first and second subsets of the matrix-coated fibers includes revolving the first subset of the matrix-coated fibers through a range different than a revolving range of the second subset of the matrix-coated fibers.

7. The method of claim 2, wherein revolving the first and second subsets of the matrix-coated fibers includes continuously revolving the first subset of the matrix-coated fibers in the first direction and selectively revolving the second subset of the matrix coated fibers in the first direction.

8. The method of claim 2, wherein revolving the first and second subsets of the matrix-coated fibers includes revolving the first subset of the matrix-coated fibers at a first rate and revolving the second subset of the matrix-coated fibers at a second rate.

9. The method of claim 8, further including dynamically adjusting the first and second rates during manufacturing of the composite hollow structure.

10. The method of claim 2, further including dynamically adjusting a pattern of weave created by revolving the first and second subsets of matrix-coated fibers during manufacturing of the composite hollow structure.

11. The method of claim 2, further including pressing the first subset of the matrix-coated fibers against the second subset of the matrix-coated fibers.

12. The method of claim 11, further including varying the pressing to thereby adjust a wall thickness of the composite hollow structure.

13. The method of claim 2, wherein the first subset of the matrix-coated fibers has at least one of a different diameter and a different material type than the second subset of the matrix-coated fibers.

14. The method of claim 2, wherein the first subset of the matrix-coated fibers has a different type of matrix than the second subset of the matrix-coated fibers.

15. The method of claim 1, wherein curing the matrix-coated fibers includes curing the matrix-coated fibers from inside the composite hollow structure.

16. The method of claim 1, wherein curing the matrix-coated fibers includes directing at least one of UV light and ultrasonic vibrations toward the matrix-coated fibers.

17. The method of claim 16, further including controlling an environment of the matrix-coated fibers for a period of time during and after the at least one of the UV light and the ultrasonic vibrations are directed toward the matrix-coated fibers.

18. The method of claim 1, further including mechanically pinching the matrix-coated fibers prior to curing the matrix-coated fibers in order to fix a length of the composite hollow structure.

19. The method of claim 1, further including filling an interior of the composite hollow structure as the hollow structure is curing.

20. A method of continuously manufacturing a composite hollow structure, comprising:
continuously coating fibers with a matrix to form matrix-coated fibers;
revolving a first subset of the matrix-coated fibers in a first direction; and
revolving a second subset of the matrix-coated fibers in a second direction opposite the first;
diverting the first and second subsets of the matrix-coated fibers radially outward away from a non-fiber axis;
pressing the first subset of the matrix-coated fibers against the second subset of the matrix-coated fibers;
dynamically adjusting revolving of the first and second subsets of the matrix-coated fibers during manufacturing of the composite hollow structure;
curing the first and second subsets of the matrix-coated fibers to retain the adjusted first and second subsets of the matrix coated fibers; and
mechanically pinching the first and second subsets of the matrix-coated fibers prior to curing the first and second subsets of the matrix-coated fibers in order to fix a length of the composite hollow structure.