

What is claimed:

- 1.** A method for fabricating a fiber-composite part, wherein the method comprises:
forming a layup, wherein the layup includes a first fiber-bundle-based preform and a second fiber-bundle based preform, and wherein:
 - (a) the first preform is rigid, has a first shape, and comprises a first plurality of continuous, co-aligned fibers impregnated with a first matrix material,
 - (b) the second preform is rigid, has a second shape, and comprises a second plurality of continuous, co-aligned fibers impregnated with a second matrix material; andconsolidating the first preform and the second preform in a mold cavity via the application of heat and pressure; and
cooling the consolidated first preform and second preform, thereby providing a fiber-composite part.
- 2.** The method of claim 1 wherein the first shape and the second shape are individually defined by one or more non-contradictory characteristics from the group consisting of linear, non-linear, planar, non-planar, open form, and closed form.
- 3.** The method of claim 1 wherein the first shape includes a first bend and a second bend.
- 4.** The method of claim 3 wherein the first bend and the second bend are out-of-plane with respect to one another, the first preform therefore characterized as non-planar.
- 5.** The method of claim 4 wherein the first bend and the second bend are orthogonal to one another.
- 6.** The method of claim 1 wherein the first matrix material and the second matrix material are different from one another.
- 7.** The method of claim 1 wherein the first preform and the second preform differ from one another in at least one characteristic selected from the group consisting of fiber type, fiber volume fraction, fiber distribution, matrix composition.

8. The method of claim 1 wherein forming a layup further comprises positioning the first and second preforms so that at least a portion of the second preform is adjacent to at least a portion of the first preform.

9. The method of claim 1 wherein the first shape is different from the second shape.

10. The method of claim 1 wherein the fiber-composite part comprises:

- (a) a first section having a first portion, wherein the first portion comprises the first plurality of co-aligned fibers sourced from the first preform;
- (b) a second section having a first portion, wherein the first portion of the second section comprises the second plurality of co-aligned fibers sourced from the second preform;
- (c) wherein the first section and the second section are contiguous; and
- (d) wherein the first section experiences first stresses and the second section experiences second stresses when the fiber composite is in use due to applied forces, the first section being at a first volumetric region of the fiber-composite part and the second section being at a second volumetric region of the fiber-composite part;
- (e) wherein the first and second stresses differ from one another in at least one of direction and magnitude;

and wherein forming the layup further comprises positioning the first preform in the layup so that the first plurality of co-aligned fibers therefrom occupy the first volumetric region, and positioning the second preform in the layup so that the second plurality of co-aligned fibers therefrom occupy the second volumetric region.

11. The method of claim 10 wherein the first plurality of fibers comprise a different material than the second plurality of fibers.

12. The method of claim 10 wherein a fiber volume fraction of the first plurality of fibers in the first preform is different from a fiber volume fraction of the second plurality of fibers in the second preform.

13. The method of claim 10 wherein forming the layup further comprises positioning the first preform and the second preform so that said first and second preforms are not co-linear with respect to one another in the layup.

14. The method of claim 10 wherein forming the layup further comprises positioning the first preform and the second preform so that said first and second preforms are not parallel with respect to one another in the layup.

15. The method of claim 10 wherein forming the layup further comprises positioning the first preform and the second preform so that said first and second preforms are orthogonal with respect to one another in the layup.

16. The method of claim 1 wherein the fiber-composite part comprises:

- (a) a first section having a first portion, wherein the first portion comprises the first plurality of co-aligned fibers sourced from the first preform;
- (b) a second section having a first portion, wherein the first portion of the second section comprises the second plurality of co-aligned fibers sourced from the second preform;
- (c) wherein the first section and the second section are contiguous; and
- (d) wherein by virtue of a difference in at least one characteristic between the first preform and second preform, the first section of the part is relatively more stiff than the second section of the part, the first section being at a first volumetric region of the fiber-composite part and the second section being at a second volumetric region of the fiber-composite part;

and wherein forming the layup further comprises positioning the first preform in the layup so that the first plurality of co-aligned fibers therefrom occupy the first volumetric region, and positioning the second preform in the layup so that the second plurality of co-aligned fibers therefrom occupy the second volumetric region.

17. The method of claim 1 wherein the fiber-composite part comprises:

- (a) a first section having a first portion, wherein the first portion comprises the first plurality of co-aligned fibers sourced from the first preform;
- (b) a second section having a first portion, wherein the first portion of the second section comprises the second plurality of co-aligned fibers sourced from the second preform;
- (c) wherein the first section and the second section are contiguous; and
- (d) wherein by virtue of a difference in at least one characteristic between the first preform and second preform, the first section of the part is relatively more

electrically conductive than the second section of the part, the first section being at a first volumetric region of the fiber-composite part and the second section being at a second volumetric region of the fiber-composite part;

and wherein forming the layup further comprises positioning the first preform in the layup so that the first plurality of co-aligned fibers therefrom occupy the first volumetric region, and positioning the second preform in the layup so that the second plurality of co-aligned fibers therefrom occupy the second volumetric region.

18. The method of claim 1 wherein the fiber-composite part comprises:

- (a) a first section having a first portion, wherein the first portion comprises the first plurality of co-aligned fibers sourced from the first preform;
- (b) a second section having a first portion, wherein the first portion of the second section comprises the second plurality of co-aligned fibers sourced from the second preform;
- (c) wherein the first section and the second section are contiguous; and
- (d) wherein by virtue of a difference in at least one characteristic between the first preform and second preform, the first section of the part is relatively more thermally conductive than the second section of the part, the first section being at a first volumetric region of the fiber-composite part and the second section being at a second volumetric region of the fiber-composite part;

and wherein forming the layup further comprises positioning the first preform in the layup so that the first plurality of co-aligned fibers therefrom occupy the first volumetric region, and positioning the second preform in the layup so that the second plurality of co-aligned fibers therefrom occupy the second volumetric region.

19. A method for fabricating a fiber-composite part, wherein the method comprises:

forming a layup, wherein the layup includes a first fiber-bundle-based preform and a second fiber-bundle based preform, and wherein:

- (a) the first preform is rigid, has a first shape that is non-planar wherein the first shape includes two bends that are out-of-plane with respect to one another, and comprises a first plurality of continuous fibers impregnated with a thermoplastic resin matrix,
- (b) the second preform is rigid, has a second shape, and comprises a second plurality of continuous fibers impregnated with the thermoplastic resin matrix; and consolidating the first preform and the second preform in a mold cavity via the

application of heat and pressure; and

cooling the consolidated first preform and second preform, thereby providing a fiber-composite part.

20. The method of claim 19 wherein forming a layup further comprises placing the first and second preforms in a mold cavity.

21. The method of claim 19 wherein forming a layup further comprises positioning the first preform in the layup such that the first plurality of continuous fibers from the first preform occupies a first volumetric region of the fiber-composite part, and wherein the first volumetric region experiences first stresses when the fiber-composite part is in use, and wherein the method further comprises:

fabricating the first preform to include an appropriate fiber type, fiber volume fraction, and/or fiber distribution to enable the first volumetric region to withstand the first stresses.

22. The method of claim 21 wherein forming a layup further comprises positioning the second preform in the layup such that the second plurality of continuous fibers from the second preform occupies a second volumetric region of the fiber-composite part, and wherein the second volumetric region experiences second stresses when the fiber-composite part is in use and which differ from the first stresses, and wherein the method further comprises:

fabricating the second preform to include an appropriate fiber type, fiber volume fraction, and/or fiber distribution to enable the second volumetric region to withstand the second stresses, and wherein at least one of the fiber type, fiber volume fraction, or fiber distribution of the second preform differs from that of the first preform.

23. The method of claim 19 wherein the second shape is different than the first shape.

24. A fiber-composite part comprising:

a first section at a first volumetric region of the fiber-composite part, the first section having:

- (a) a first portion, wherein the first portion comprises a first plurality of co-aligned fiber;
- (b) a second portion, wherein the second portion comprises a second plurality of co-aligned fiber;

a second section at a second volumetric region of the fiber-composite part, wherein the first second and the second section are contiguous with one another, the second section having:

- (a) a first portion, wherein the first portion of the second section comprises the first plurality of co-aligned fiber;
- (b) a second portion, wherein the second portion of the second section comprises a third plurality of co-aligned fiber, wherein the second plurality of co-aligned fiber and the third plurality of co-aligned fiber differ from one another in a characteristic selected from the group consisting of fiber type, fiber volume fraction, and fiber distribution.