What is claimed is:

1. A blade comprising:

an airfoil portion formed from a first metallic material, having a forward airfoil edge, a first airfoil surface, and a second airfoil surface; and

a sheath portion formed from a second metallic material, the sheath portion having a sheath head section, a first sheath flank and a second sheath flank, both flanks extending chordwise rearwardly from the forward sheath section;

wherein the sheath portion is bonded to the airfoil portion such that the sheath head section covers the forward airfoil edge to define a blade leading edge; the first sheath flank covers a portion of the first airfoil surface proximate the airfoil forward edge, jointly defining a blade suction surface; and the second sheath flank covers a portion of the second airfoil surface proximate the airfoil forward edge, jointly defining a blade pressure surface opposite the blade suction surface.

2. The blade of claim 1, wherein a density of the first metallic material is between about 10% and about 60% less than a density of the second metallic material.

3. The blade of claim 2, wherein the density of the first metallic material is between about 25% and about 50% less than the density of the second metallic material.

4. The blade of claim 1, wherein a yield strength of the first metallic material is between about 10% and about 60% less than a yield strength of the second metallic material.

5. The blade of claim 4, wherein the yield strength of the first metallic material is between about 20% and about 50% less than the yield strength of the second metallic material.

6. The blade of claim 1, wherein the airfoil portion is formed from an aluminum alloy.

7. The blade of claim 6, wherein the aluminum alloy is a 7XXX-series alloy.

8. The blade of claim 1, wherein the sheath portion is formed from a titanium alloy.

9. The blade of claim 8, wherein the titanium alloy also includes aluminum and vanadium.

10. The blade of claim 9, wherein the titanium alloy is a Ti-6Al-4V alloy.

11. The blade of claim 1, wherein the sheath portion is bonded to the airfoil portion with an epoxy-based adhesive.

12. The blade of claim 11, wherein the epoxy-based adhesive is a film.

13. The blade of claim 12, wherein the blade further comprises a dielectrically protective scrim sheet disposed between layers of adhesive film.

14. The blade of claim 1, wherein a chordwise dimension of the sheath head section is between than about 3% and 20% of an average chordwise dimension in a inner span region of the blade.

15. The blade of claim 14, wherein a chordwise dimension of the sheath head section is between about 3% and about 20% of an average chordwise dimension in an outer span region of the blade.

16 The blade of claim 1, wherein the sheath second flank has a longer chordwise dimension on the blade pressure surface than the chordwise dimension of the first flank on the blade suction surface.

17. The blade of claim 16, wherein a chordwise dimension of the sheath first flank and a chordwise dimension of the sheath second flank are each between about 8% and about 30% of an average chordwise dimension of the blade.

18. A method of making a blade, the method comprising:

forming an airfoil portion from a lightweight metallic material, the airfoil portion having a forward airfoil edge, a first airfoil surface and a second airfoil surface;

forming a sheath portion from a high-strength metallic material, the sheath section having a sheath head section, a first sheath flank, and a second sheath flank;

forming receiving surfaces on a portion of the first airfoil surface and a portion of the second airfoil surface proximate the airfoil forward edge to accommodate the sheath portion;

covering the forward airfoil edge and the receiving surfaces of the airfoil portion with the sheath portion; and

bonding the sheath portion and the airfoil portion.

19. The method of claim 18, wherein the bonding step is performed with epoxy-based adhesive.

20. The method of claim 18, further comprising machining the blade to form a flush suction surface and a flush pressure surface between the sheath portion and the airfoil portion.

CLAIMS

1. A blade comprising:

an airfoil portion formed from a monolithic first metallic material, the airfoil portion having a forward airfoil edge, a first airfoil surface, and a second airfoil surface, each airfoil surface extending from proximate a platform to proximate a blade tip edge;

a sheath portion formed from a second metallic material, the sheath portion having a solid sheath head section, a first sheath flank and a second sheath flank, the solid sheath head section extending chordwise forwardly from the forward airfoil edge, and both flanks extending chordwise rearwardly from a junction of the sheath head section and the forward airfoil edge such that the sheath head section defines a thickness of the blade forward of the forward airfoil edge up to and including a blade leading edge continuously from proximate the platform and terminating proximate the blade tip edge; and

a dielectrically protective nylon-based scrim sheet disposed between the sheath portion and the airfoil portion;

wherein the first metallic material is an aluminum alloy;

wherein the sheath portion is a single piece bonded to the airfoil portion such that the sheath head section covers the forward airfoil edge; the first sheath flank covers a portion of the first airfoil surface proximate the airfoil forward edge, jointly defining a blade suction surface; and the second sheath flank covers a portion of the second airfoil surface proximate the airfoil forward edge, jointly defining a blade pressure surface opposite the blade suction surface; and

wherein a chordwise dimension of the sheath head section is at least 3% of a chordwise blade dimension in an inner span region, and at least 8% of a chordwise blade dimension in a distal span region.

2. The blade of claim 1, wherein a density of the first metallic material is between about 10% and about 60% less than a density of the second metallic material.

3. The blade of claim 2, wherein the density of the first metallic material is between about 25% and about 50% less than the density of the second metallic material.

4. The blade of claim 1, wherein a yield strength of the first metallic material is between about 10% and about 60% less than a yield strength of the second metallic material.

5. The blade of claim 4, wherein the yield strength of the first metallic material is between about 20% and about 50% less than the yield strength of the second metallic material.

6. The blade of claim 1, wherein the aluminum alloy is a 7XXX-series alloy.

7. The blade of claim 1, wherein the sheath portion is formed from a titanium alloy.

8. The blade of claim 7, wherein the titanium alloy also includes aluminum and vanadium.

9. The blade of claim 8, wherein the titanium alloy is a Ti-6Al-4V alloy.

10. The blade of claim 1, wherein the sheath portion is bonded to the airfoil portion with an epoxy-based adhesive.

11. The blade of claim 10, wherein the epoxy-based adhesive is a film.

12. The blade of claim 1, wherein the chordwise dimension of the sheath head section is between about 3% and 20% of the chordwise dimension in the inner span region.

13. The blade of claim 1, wherein the chordwise dimension of the sheath head section is between about 8% and about 20% of the chordwise dimension in the outer span region.

14. The blade of claim 1, wherein the sheath second flank has a longer chordwise dimension on the blade pressure surface than the chordwise dimension of the first flank on the blade suction surface.

15. The blade of claim 14, wherein a chordwise dimension of the sheath first flank and a chordwise dimension of the sheath second flank are each between about 8% and about 30% of an average chordwise dimension of the blade.

16. The blade of claim 1, wherein the sheath portion comprises no more than 50% of a chordwise dimension of any portion of the blade along either the suction surface or the pressure surface.

17. The blade of claim 1, wherein the sheath head section includes a substantially constant chordwise dimension along an outer sheath region, and a tapered chordwise dimension along an inner sheath region.

18. The blade of claim 17, wherein the first sheath flank and the second sheath flank each include a substantially constant chordwise dimension along an outer sheath region, and a tapered chordwise dimension along an inner sheath region.

19. The blade of claim 18, wherein a first thickness of the first sheath flank and a second thickness of the second sheath flank are each tapered along the chordwise dimension along both the outer sheath region and the inner sheath region.

20. A method of making a blade, the method comprising:

forming an airfoil portion from a monolithic aluminum alloy, the airfoil portion having a forward airfoil edge, a first airfoil surface and a second airfoil surface, each airfoil surface extending from proximate a platform to proximate a blade tip edge;

forming a sheath portion from a high-strength metallic material, the sheath section having a solid sheath head section, a first sheath flank, and a second sheath flank, both flanks extending chordwise rearwardly from the sheath

head section;

forming receiving surfaces on a portion of the first airfoil surface and a portion of the second airfoil surface proximate the airfoil forward edge to accommodate the sheath portion;

placing a dielectrically protective nylon-based scrim sheet over at least one of the sheath portion, the forward airfoil edge, and the receiving surfaces of the airfoil portion;

covering the forward airfoil edge and the receiving surfaces of the airfoil portion with the sheath portion such that the solid sheath head section extends chordwise forwardly from the forward airfoil edge, and such that the sheath head section defines a thickness of the blade forward of the forward airfoil edge up to and including a blade leading edge continuously from proximate the platform and terminating proximate the blade tip edge; and

adhesively bonding the dielectrically protective scrim sheet between the sheath portion and the airfoil portion;

wherein a chordwise dimension of the sheath head section is at least 3% of a chordwise blade dimension in an inner span region, and at least 8% of a chordwise blade dimension in a distal span region.

21. The method of claim 20, wherein the bonding step is performed with epoxy-based adhesive.

22. The method of claim 20, further comprising machining the blade to form a flush suction surface and a flush pressure surface between the sheath portion and the airfoil portion.

23. A sheath for a gas turbine blade comprising:

a solid metallic head section defining a thickness of the blade forward of the forward airfoil edge up to and including a blade leading edge continuously including a suction surface and a pressure surface, the suction surface and the pressure surface each extending chordwise from a leading edge surface, and extending spanwise between a sheath root end and a sheath tip end, the sheath tip end corresponding to a portion of an airfoil tip end;

a suction side flank including an outer surface contiguous with the suction surface of the head section, the suction side flank extending spanwise between the sheath root end and the sheath tip end;

a pressure side flank including an outer surface contiguous with the pressure surface of the head section, the pressure side flank extending spanwise between the sheath root end and the sheath tip end; and

a dielectrically protective nylon-based scrim sheet applied to an inner surface of one or more of the head section, the suction side flank, and the pressure side flank;

wherein the solid metallic head section, the suction side flank, and the pressure side flank form a contiguous sheath surface adapted to receive a forward airfoil edge of an airfoil portion formed from a monolithic aluminum alloy; and

wherein a chordwise dimension of the sheath head section is at least 3% of a chordwise blade dimension in an inner span region, and at least 8% of a chordwise blade dimension in a distal span region.

24. The sheath of claim 23, wherein the sheath portion is formed from an alloy selected from one of: a titanium alloy, and a nickel alloy.

25. The sheath of claim 24, wherein the first sheath flank and the second sheath flank each include a substantially constant chordwise dimension along an outer sheath region, and a tapered chordwise dimension along an inner sheath region.

26. The sheath of claim 23, wherein the sheath head section includes a substantially constant chordwise dimension along an outer sheath region, and a tapered chordwise dimension along an inner sheath region.

27. The sheath of claim 26, wherein a first thickness of the first sheath flank and a second thickness of the second sheath flank are each tapered along the chordwise dimension along both the outer sheath region and the inner sheath region.

28. The sheath of claim 23, wherein at least one of the suction side flank and the pressure side flank are diffusion bonded to the head section.