CLAIMS

What is claimed is:

1. A method of fabricating an airfoil assembly comprising:

fabricating a first core including a first plurality of ribs defining a first plurality of cooling passages of a completed airfoil assembly, wherein the first core is fabricated from a first material;

fabricating as second core including a second plurality of ribs defining a second plurality of cooling passages of the completed airfoil assembly, wherein the second plurality of ribs includes a plurality of standoffs, wherein the second core is fabricated from a second material different than the first material;

assembling the first core and the second core into a core assembly such that the plurality of standoffs set a spacing between the first plurality of ribs and the second plurality of ribs to define a spacing between the first plurality of cooling passages and the second plurality of passages of the completed airfoil;

molding the airfoil assembly around the core assembly; and

removing the core assembly including the first core and the second core.

2. The method as recited in claim 1, wherein the plurality of standoffs extend from the second plurality of ribs.

3. The method as recited in claim 1, wherein the first plurality of ribs define a plurality of microcircuit cooling passages in the completed airfoil assembly.

4. The method as recited in claim 1, wherein the airfoil assembly includes a root portion, a platform and a tip with the first plurality of ribs defining the first plurality of cooling passages between the root portion and the platform.

5. The method as recited in claim 4, wherein the first core includes a third plurality of ribs separated from the first plurality of ribs for defining a third plurality of cooling passages from the platform to the tip.

6. The method as recited in claim 5, including cross ties between the first plurality of ribs and the second plurality of ribs for defining cross channels disposed proximate the platform between the first plurality of cooling passages and the third plurality of cooling passages in the completed airfoil assembly.

7. The method as recited in claim 1, wherein at least one of the first core and the second core include features for defining openings in a tip of a completed airfoil assembly.

8. The method as recited in claim 7, wherein the tip of the completed airfoil includes a recessed portion and the openings are defined in the recessed portion.

9. The method as recited in claim 1, wherein the first core defines a plurality of pedestals.

10. The method as recited in claim 1, wherein the first material comprises a refractory metal and the second material comprises a ceramic material.

11. A core assembly for fabricating an airfoil comprising:

a first core including a first plurality of ribs defining a first plurality of cooling passages of a completed airfoil assembly, the first core fabricated from a first material;

a second core including a second plurality of ribs defining a second plurality of cooling passages of the completed airfoil assembly, the second core fabricated from a second material different than the first material,

a plurality of standoffs spacing the first plurality of ribs apart from the second plurality of ribs to define a spacing between the first plurality of cooling passages and the second plurality of cooling passages of a completed airfoil.

12. The core assembly as recited in claim 11, wherein the plurality of standoffs extend from the second plurality of ribs.

13. The core assembly as recited in claim 11, wherein the first core includes a third plurality of ribs separated from the first plurality of ribs by a plurality of cross ties for defining cross channels disposed proximate a platform of a completed airfoil.

14. The core assembly as recited in claim 11, wherein at least one of the first core and the second core include features for defining openings in a tip of a completed airfoil.

15. The core assembly as recited in claim 14, wherein the tip of the completed airfoil includes a recessed portion and the openings are defined within the recessed portion.

16. The core assembly as recited in claim 11, wherein the first core defines a plurality of pedestals.

17. The core assembly as recited in claim 11, wherein the first material comprises a refractory metal and the second material comprise a ceramic material.

18. A turbine airfoil assembly comprising:

a hollow airfoil section into which cooling flow is receivable from an end of an airfoil, the airfoil including pressure and suction sidewalls joined together at leading and trailing edges and extending from a root to a tip;

a platform extending outward from the root;

a first plurality of microcircuit cooling passages extending from the root to the tip;

a first plurality of cooling passages extending from the root to the tip substantially parallel to the first plurality of microcircuit cooling passages; and

a plurality of standoffs spacing the first plurality of microcircuit cooling passages apart from the first plurality of cooling passages.

19. The turbine airfoil assembly as recited in claim 18, including a second plurality of microcircuit cooling passages extending from the platform to the tip and spaced apart from the first plurality of microcircuit cooling passages by a plurality of cross ties defining channels substantially transverse to the first and second plurality of microcircuit cooling passages.

20. The turbine airfoil assembly as recited in claim 19, wherein each of the first and second plurality of microcircuit cooling passages include an end that terminates at the cross ties proximate the platform.

21. The turbine airfoil assembly as recited in claim 18, including openings through the tip for cooling airflow.

22. The turbine airfoil assembly as recited in claim 21, wherein the tip of the completed airfoil includes a recessed portion and the openings are defined in the recessed portion.

23. The turbine airfoil assembly as recited in claim 18, including a plurality of pedestals within at least one of them first plurality of microcircuit cooling passages and the first plurality of cooling passages for generating improved thermal transfer to cooling airflow.

Claims

1. A method of fabricating an airfoil assembly comprising:

fabricating a first core including a first plurality of ribs defining a first plurality of cooling passages of a completed airfoil assembly, wherein the first core is fabricated from a first material;

fabricating as second core including a second plurality of ribs defining a second plurality of cooling passages of the completed airfoil assembly, wherein the second plurality of ribs includes a plurality of standoffs, wherein the second core is fabricated from a second material different than the first material;

assembling the first core and the second core into a core assembly such that the plurality of standoffs set a spacing between the first plurality of ribs and the second plurality of ribs to define a spacing between the first plurality of cooling passages and the second plurality of passages of the completed airfoil, wherein at least one of the first core and the second core include features for defining openings in a tip of a completed airfoil assembly, the tip of the completed airfoil includes a recessed portion and the openings are defined in the recessed portion;

molding the airfoil assembly around the core assembly; and

removing the core assembly including the first core and the second core.

2. The method as recited in claim 1, wherein the plurality of standoffs extend from the second plurality of ribs.

3. The method as recited in claim 1, wherein the first plurality of ribs define a plurality of microcircuit cooling passages in the completed airfoil assembly.

4. The method as recited in claim 1, wherein the airfoil assembly includes a root portion, a platform and a tip with the first plurality of ribs defining the first plurality of cooling passages between the root portion and the platform.

5. The method as recited in claim 4, wherein the first core includes a third plurality of ribs separated from the first plurality of ribs for defining a third plurality of cooling passages from the platform to the tip.

6. The method as recited in claim 5, including cross ties between the first plurality of ribs and the third plurality of ribs for defining cross channels disposed proximate the platform between the first plurality of cooling passages and the third plurality of cooling passages in the completed airfoil assembly.

7. The method as recited in claim 1, wherein the first core defines a plurality of pedestals.

8. The method as recited in claim 1, wherein the first material comprises a refractory metal and the second material comprises a ceramic material.

9. A core assembly for fabricating an airfoil comprising:

a first core including a first plurality of ribs defining a first plurality of cooling passages of a completed airfoil assembly, the first core fabricated from a first material;

a second core including a second plurality of ribs defining a second plurality of cooling passages of the completed airfoil assembly, the second core fabricated from a second material different than the first material, wherein the tip of the completed airfoil includes a recessed portion and at least one of the first core and the second core include features for defining openings in the recessed portion of the tip,

a plurality of standoffs spacing the first plurality of ribs apart from the second plurality of ribs to define a spacing between the first plurality of cooling passages and the second plurality of cooling passages of a completed airfoil.

10. The core assembly as recited in claim 9, wherein the plurality of standoffs extend from the second plurality of ribs.

11. The core assembly as recited in claim 9, wherein the first core includes a third plurality of ribs separated from the first plurality of ribs by a plurality of cross ties for defining cross channels disposed proximate a platform of a completed airfoil.

12. The core assembly as recited in claim 9, wherein the first core defines a plurality of pedestals.

13. The core assembly as recited in claim 9, wherein the first material comprises a refractory metal and the second material comprise a ceramic material.

14. A turbine airfoil assembly comprising:

a hollow airfoil section into which cooling flow is receivable from an end of an airfoil, the airfoil including pressure and suction sidewalls joined together at leading and trailing edges and extending from a root to a tip, the tip including a recessed portion, the recessed portion defining a surface spaced apart from the tip in a direction toward the root portion;

a platform extending outward from the root;

a first plurality of microcircuit cooling passages extending from the root to the tip;

a first plurality of cooling passages extending from the root to the tip substantially parallel to the first plurality of microcircuit cooling passages;

openings through the tip and defined within the recessed portion, the openings in communication with one of the first plurality of microcircuit cooling passages and the first plurality of cooling passages for providing cooling within the recessed portion; and

a plurality of standoffs spacing the first plurality of microcircuit cooling passages apart from the first plurality of cooling passages.

15. The turbine airfoil assembly as recited in claim 14, including a second plurality of microcircuit cooling passages extending from the platform to the tip and spaced apart from the first plurality of microcircuit cooling passages by a plurality of cross ties defining channels substantially transverse to the first and second plurality of microcircuit cooling passages.

16. The turbine airfoil assembly as recited in claim 15, wherein each of the first and second plurality of microcircuit cooling passages include an end that terminates at the cross ties proximate the platform.

17. The turbine airfoil assembly as recited in claim 14, including a plurality of pedestals within at least one of them first plurality of microcircuit cooling passages and the first plurality of cooling passages for generating improved thermal transfer to cooling airflow.

18. The method as recited in claim 1, including supporting a third core on one of the first core and the second core, and defining openings through a tip of the airfoil with portions of the third core.

19. The method as recited in claim 1, wherein the recessed portion comprises a surface disposed radially inward of the tip.

20. The core assembly as recited in claim 9, including a third core supported on one of the first core and the second core, the third core defining openings through the tip.