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## Airfoil with sandwich composite flange


### Abstract

An airfoil for a gas turbine engine includes an airfoil section and a platform that has a non-gaspath side, a flange that extends from the non-gaspath side, and a gaspath side from which the airfoil section extends. The flange is comprised of a sandwich composite that includes first and second ceramic matrix composite (CMC) skins that each have at least one 2-D ceramic fiber ply, and a cellular core disposed between the first and second CMC skins.



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## Background/Summary

BACKGROUND

(1) A gas turbine engine typically includes a fan section, a compressor section, a combustor section and a turbine section. Air entering the compressor section is compressed and delivered into the combustion section where it is mixed with fuel and ignited to generate a high-pressure and temperature exhaust gas flow. The high-pressure and temperature exhaust gas flow expands through the turbine section to drive the compressor and the fan section. The compressor section may include low and high pressure compressors, and the turbine section may also include low and high pressure turbines.

(2) Airfoils in the turbine section are typically formed of a superalloy and may include thermal barrier coatings to extend temperature capability and lifetime. Ceramic matrix composite ("CMC") materials are also being considered for airfoils. Among other attractive properties, CMCs have high temperature resistance. Despite this attribute, however, there are unique challenges to implementing CMCs in airfoils.

SUMMARY

(3) An airfoil for a gas turbine engine according to an example of the present disclosure includes an airfoil section and a platform having a gaspath side and a non-gaspath side. A flange extends from

the non-gaspath side, and the airfoil section extends from the gaspath side. The flange is comprised of a sandwich composite that has first and second ceramic matrix composite (CMC) skins each including at least one 2-D ceramic fiber ply, and a cellular core disposed between the first and second CMC skins.

(4) In a further embodiment of any of the foregoing embodiments, the first and second CMC skins include, respectively, first and second radially upturned tabs that extend in the flange, and the cellular core is disposed between the first and second radially upturned tabs.

(5) In a further embodiment of any of the foregoing embodiments, the cellular core includes a base portion that extends in the platform adjacent the flange and a ridge that radially protrudes from the base portion and extends between the first and second radially upturned tabs.

(6) In a further embodiment of any of the foregoing embodiments, the sandwich composite includes a third CMC skin including at least one 2-D ceramic fiber ply on the gaspath side of the platform, with the cellular core being radially disposed between the third CMC skin and each of the first and second CMC skins.

(7) In a further embodiment of any of the foregoing embodiments, the flange defines a radial flange face, and the ridge defines a radial ridge face proximate the radial flange face.

(8) In a further embodiment of any of the foregoing embodiments, the first radially upturned tab is axially forward of the second radially upturned tab.

(9) In a further embodiment of any of the foregoing embodiments, the base portion of the cellular core defines an axial length in the platform and the ridge defines a radial thickness at the flange, and the axial length is greater than the radial thickness.

(10) In a further embodiment of any of the foregoing embodiments, the cellular core is selected from the group consisting of a honeycomb, a foam, a ceramic felt, a 3-D fabric, a monolithic ceramic grid, and combinations thereof.

(11) In a further embodiment of any of the foregoing embodiments, the cellular core is selected from the group consisting of a honeycomb, a foam, a monolithic ceramic grid, and combinations thereof.

(12) In a further embodiment of any of the foregoing embodiments, the cellular core includes cells that are void.

(13) In a further embodiment of any of the foregoing embodiments, the cellular core includes cells that contain a filler material.

(14) A gas turbine engine according to an example of the present disclosure includes a compressor section, a combustor in fluid communication with the compressor section, and a turbine section in fluid communication with the combustor. The turbine section has an airfoil in accordance with any of the preceding embodiments.

(15) A method for fabricating an airfoil for a gas turbine engine according to an example of the present disclosure includes providing a core blank made of a cellular material, shaping the core blank into a cellular core, and forming a fiber preform that has an airfoil section and a platform by laying-up first and second ceramic fiber ply skins on the cellular core such that in a flange on the platform the cellular core is sandwiched between the first and second ceramic fiber ply skins. The fiber preform is then densified with a ceramic matrix. The first and second ceramic fiber ply skins each have at least one 2-D ceramic fiber ply.

(16) In a further embodiment of any of the foregoing embodiments, the core blank is selected from the group consisting of a honeycomb, a foam, a ceramic felt, a 3-D fabric, a monolithic ceramic grid, and combinations thereof.

(17) In a further embodiment of any of the foregoing embodiments, the shaping includes machining the core blank.

(18) In a further embodiment of any of the foregoing embodiments, the machining forms a ridge on the cellular core, and the first and second ceramic fiber ply skins conform to the ridge.

(19) The present disclosure may include any one or more of the individual features disclosed above and/or below alone or in any combination thereof.

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## Description

BRIEF DESCRIPTION OF THE DRAWINGS

(1) The various features and advantages of the present disclosure will become apparent to those skilled in the art from the following detailed description. The drawings that accompany the detailed description can be briefly described as follows.

(2) FIG. **1** illustrates a gas turbine engine.

(3) FIG. **2** illustrates an airfoil from the turbine section of the engine.

(4) FIG. **3** illustrates a sandwich composite of the airfoil.

(5) FIG. **4** illustrates a cellular core of the sandwich composite.

(6) FIG. **5** illustrates a foam of a cellular core.

(7) FIG. **6** illustrates a ceramic felt of a cellular core.

(8) FIG. **7** illustrates a 3-D fabric of a cellular core.

(9) FIG. **8** illustrates a monolithic ceramic honeycomb of a cellular core.

(10) FIG. **9** illustrates a cellular core with a filler material in the cells.

(11) FIG. **10** illustrates a flange with an “L” joint configuration.

(12) FIG. **11** illustrates a method for fabricating an airfoil with a sandwich composite.

(13) In this disclosure, like reference numerals designate like elements where appropriate and reference numerals with the addition of one-hundred or multiples thereof designate modified elements that are understood to incorporate the same features and benefits of the corresponding elements. Terms such as “first” and “second” used herein are to differentiate that there are two architecturally distinct components or features. Furthermore, the terms “first” and “second” are interchangeable in that a first component or feature could alternatively be termed as the second component or feature, and vice versa.

DETAILED DESCRIPTION

(14) FIG. **1** schematically illustrates a gas turbine engine **20**. The gas turbine engine **20** is disclosed herein as a two-spool turbofan that generally incorporates a fan section **22**, a compressor section **24**, a combustor section **26** and a turbine section **28**. The fan section **22** drives air along a bypass flow path B in a bypass duct defined within a housing **15** such as a fan case or nacelle, and also drives air along a core flow path C for compression and communication into the combustor section **26** then expansion through the turbine section **28**. Although depicted as a two-spool turbofan gas turbine engine in the disclosed non-limiting embodiment, it should be understood that the concepts described herein are not limited to use with two-spool turbofans as the teachings may be applied to other types of turbine engines including three-spool architectures.

(15) The exemplary engine **20** generally includes a low speed spool **30** and a high speed spool **32** mounted for rotation about an engine central longitudinal axis A relative to an engine static structure **36** via several bearing systems **38**. It should be understood that various bearing systems **38** at various locations may alternatively or additionally be provided, and the location of bearing systems **38** may be varied as appropriate to the application.

(16) The low speed spool **30** generally includes an inner shaft **40** that interconnects, a first (or low) pressure compressor **44** and a first (or low) pressure turbine **46**. The inner shaft **40** is connected to the fan **42** through a speed change mechanism, which in exemplary gas turbine engine **20** is illustrated as a geared architecture **48** to drive a fan **42** at a lower speed than the low speed spool **30**. The high speed spool **32** includes an outer shaft **50** that interconnects a second (or high) pressure compressor **52** and a second (or high) pressure turbine **54**. A combustor **56** is arranged in the exemplary gas turbine **20** between the high pressure compressor **52** and the high pressure

turbine **54**. A mid-turbine frame **57** of the engine static structure **36** may be arranged generally between the high pressure turbine **54** and the low pressure turbine **46**. The mid-turbine frame **57** further supports bearing systems **38** in the turbine section **28**. The inner shaft **40** and the outer shaft **50** are concentric and rotate via bearing systems **38** about the engine central longitudinal axis A which is collinear with their longitudinal axes.

(17) The core airflow is compressed by the low pressure compressor **44** then the high pressure compressor **52**, mixed and burned with fuel in the combustor **56**, then expanded through the high pressure turbine **54** and low pressure turbine **46**. The mid-turbine frame **57** includes airfoils **59** which are in the core airflow path C. The turbines **46**, **54** rotationally drive the respective low speed spool **30** and high speed spool **32** in response to the expansion. It will be appreciated that each of the positions of the fan section **22**, compressor section **24**, combustor section **26**, turbine section **28**, and fan drive gear system **48** may be varied. For example, gear system **48** may be located aft of the low pressure compressor, or aft of the combustor section **26** or even aft of turbine section **28**, and fan **42** may be positioned forward or aft of the location of gear system **48**.

(18) The engine **20** in one example is a high-bypass geared aircraft engine. In a further example, the engine **20** bypass ratio is greater than about six (6), with an example embodiment being greater than about ten (10), and can be less than or equal to about 18.0, or more narrowly can be less than or equal to 16.0. The geared architecture **48** is an epicyclic gear train, such as a planetary gear system or other gear system, with a gear reduction ratio of greater than about 2.3. The gear reduction ratio may be less than or equal to 4.0. The low pressure turbine **46** has a pressure ratio that is greater than about five. The low pressure turbine pressure ratio can be less than or equal to 13.0, or more narrowly less than or equal to 12.0. In one disclosed embodiment, the engine **20** bypass ratio is greater than about ten (10:1), the fan diameter is significantly larger than that of the low pressure compressor **44**, and the low pressure turbine **46** has a pressure ratio that is greater than about five 5:1. Low pressure turbine **46** pressure ratio is pressure measured prior to an inlet of low pressure turbine **46** as related to the pressure at the outlet of the low pressure turbine **46** prior to an exhaust nozzle. The geared architecture **48** may be an epicycle gear train, such as a planetary gear system or other gear system, with a gear reduction ratio of greater than about 2.3:1 and less than about 5:1. It should be understood, however, that the above parameters are only exemplary of one embodiment of a geared architecture engine and that the present invention is applicable to other gas turbine engines including direct drive turbofans.

(19) A significant amount of thrust is provided by the bypass flow B due to the high bypass ratio. The fan section **22** of the engine **20** is designed for a particular flight condition—typically cruise at about 0.8 Mach and about 35,000 feet (10,668 meters). The flight condition of 0.8 Mach and 35,000 ft (10,668 meters), with the engine at its best fuel consumption—also known as “bucket cruise Thrust Specific Fuel Consumption (‘TSFC’)”—is the industry standard parameter of lbm of fuel being burned divided by lbf of thrust the engine produces at that minimum point. The engine parameters described above and those in this paragraph are measured at this condition unless otherwise specified. “Low fan pressure ratio” is the pressure ratio across the fan blade alone, without a Fan Exit Guide Vane (“FEGV”) system. The low fan pressure ratio as disclosed herein according to one non-limiting embodiment is less than about 1.45, or more narrowly greater than or equal to 1.25. “Low corrected fan tip speed” is the actual fan tip speed in ft/see divided by an industry standard temperature correction of [(Tram ° R)/(518.7° R)].sup.0.5. The “Low corrected fan tip speed” as disclosed herein according to one non-limiting embodiment is less than about 1150.0 ft/second (350.5 meters/second), and can be greater than or equal to 1000.0 ft/second (304.8 meters/second).

(20) FIG. **2** illustrates an airfoil **60** from the engine **20**. To demonstrate an example implementation in accordance with this disclosure, the article **60** is depicted as a turbine vane from the turbine section **28** of the engine **20**. A plurality of the turbine vanes are arranged in a circumferential row about the engine central longitudinal axis A. It is to be understood, however, that the airfoil **60** is

not limited to vanes and that the examples herein may also be applied to turbine blades.
(21) The turbine vane is comprised of several sections, including first and second platforms **62**/**64** and an airfoil section **66** that extends between the platforms **62**/**64**. Each platform **62**/**64** has a gaspath side **68** and a non-gaspath side **70**. The gaspath side **68** bounds a portion of the core flow path C of the engine **20**, while the non-gaspath side **70** is the opposite side that faces away from the core flow path C. The airfoil section **66** extends between the gaspath sides **68** and generally defines a leading edge, a trailing edge, and pressure and suction sides. In this example, the first platform **62** is a radially outer platform and the second platform **64** is a radially inner platform. The first platform **62** includes a flange **72** that projects radially from the non-gaspath side **70** surface of the platform **62**. The flange **72** serves to support the airfoil **60** in the engine **20**. For example, the airfoil **60** is supported between inner and outer fixed structures, such as inner and outer engine case structures. As will be appreciated, the second platform **64** could additionally or alternatively have a flange.
(22) Airfoils that are made of ceramic matrix composite ("CMC") materials must be designed with a geometry that is aerodynamically efficient and that can be mounted in the engine without over-stressing but that is also manufacturable from the CMC material. Such a balance has proven challenging, as many features that are known for use in metallic alloy vanes are unfeasible in CMC airfoils either because they cannot be manufactured or because they result in stresses that are higher than desired for given durability requirements. Furthermore, as designs for ceramic airfoils evolve and improve, the geometry challenges the limits of CMC component manufacturability. For instance, a CMC airfoil may be formed of a lay-up of ceramic fabric plies to form a preform. The preform is then subjected to a densification process to form the ceramic matrix. Such a densification process may include, but is not limited to, chemical vapor infiltration, melt infiltration, or polymer infiltration and pyrolysis. In these regards, the densification depends to some extent on the ability of the matrix material or matrix precursor material (i.e., infiltrants) to flow into all depths of the preform during the densification process so that the preform becomes fully densified. In some cases, however, the thickness of the preform, such as at a flange, exceeds a depth at which the infiltrants can readily flow under practical processing conditions and times and achieve the desired density. As a result, the preform becomes only partially densified, with pores or voids in the regions that the infiltrant cannot reach. To facilitate addressing this issue, the platforms **62**/**64** of the airfoil **60** are made from a sandwich composite. As will be described below, the sandwich composite enables use of a thicker wall while eliminating or reducing concerns over partial densification.
(23) FIG. **3** illustrates a representative portion of the airfoil **60**, sectioned through the platform **62** and the flange **72**. Although not shown, the platform **64** may be of the same construction. The flange **72** is comprised of a sandwich composite **71**. A sandwich composite is a composite material that has a cellular core disposed between two generally thin face skins, where the skins and the cellular core are of different materials in terms of the material architecture, though the chemical compositions may be the same or similar between the skins and core.
(24) In the example depicted, the sandwich composite **72** includes first and second ceramic matrix composite (CMC) skins **74***a*/**74***b*. Each CMC skin **74***a*/**74***b* includes at least one 2-D ceramic fiber ply **76**. In a 2-D ceramic fiber ply, the ceramic fibers or tows are interlaced in only two directions. Example ceramic materials of the CMC include silicon-containing ceramic, such as but not limited to, silicon carbide (SiC) and/or silicon nitride (Si.sub.3N.sub.4). A CMC is formed of ceramic fiber tows that are disposed in a ceramic matrix. As an example, the CMC may be, but is not limited to, a SiC/SiC composite in which SiC fiber tows are disposed within a SiC matrix.
(25) The CMC skins **74***a*/**74***b* are disposed on the non-gaspath side **70** of the platform **62**, opposite a third CMC skin **74***c* (also including at least one 2-D ceramic fiber ply **76**) on the gaspath side **68**. The CMC skins **74***a*/**74***b* generally extend axially and circumferentially along the non-gaspath side **70** and include first and second radially upturned tabs **78***a*/**78***b* that extend in the flange **72**. In the

illustrated example, the first radially upturned tab **78***a* is axially forward of the second radially upturned tab **78***b*. A cellular core **80** is disposed between the first and second CMC skins **74***a*/**74***b* and, in particular, between the radially upturned tabs **78***a*/**78***b*. The cellular core **80** is also between each of the CMC skins **74***a*/**74***b* and the CMC skin **74***c*. In this regard, the sandwich composite **72** may also be considered to include the third CMC skin **74***c*. A cellular core **80** is a material that has a cellular macro-architecture, such as but not limited to, an open or closed cell foam that has random irregularly shaped cells, a honeycomb that has uniformly shaped cells (e.g., circular, hexagonal, etc.), or a fibrous material in which the interstices between fiber tows define cells. In the illustrated example, the cellular core **80** is of the honeycomb type and defines an array of cells **80***a* that are void, i.e., empty, although in some examples the cells **80***a* may be filled or partially filled.
(26) FIG. **4** illustrates isolated view of the cellular core **80**. In this example, the cells **80***a* are rectangular (e.g., square), are open radially at both ends, and are of uniform cross-sectional size throughout the array. The cross-sectional shape of the cells **80***a*, however, may alternatively be another polygonal shape, circular, or oval. Additionally, the size of the cells **80***a* may be varied across the array. For instance, in one region of the flange **72** or of the platform **62** the cells **80***a* may be of relatively smaller size and in another region of the flange **72** or of the platform **62** the cells **80** may be of a relatively larger size. The size and shape of the cells **80***a* may be selected to locally tailor the properties of the cellular core **80** (and thus also the flange **72** and platform **62**). Additionally, the cellular core **80** could be excluded in some regions of the flange and/or platform **62**, while other regions of the flange **72** and/or platform **62** include the core **80**.
(27) As shown, the cellular core **80** includes a base portion **82** that extends in the platform **62** adjacent the flange **72** and a ridge **84** that radially protrudes from the base portion **82**. The ridge **84** extends between the radially upturned tabs **78***a*/**78***b*. The flange **72** defines a radial flange face **72***a*. The ridge **84** defines a radial ridge face **84***a* proximate the radial flange face **72***a*. For example, the radial ridge face **84***a* is flush or substantially flush with the radial flange face **72***a* such that the open ends of the cells **80***a* are exposed. In this regard, the open ends of the cells may serve as inlet for cooling air into the airfoil **60**. Alternatively, the ridge **84** may stop short of the radial flange face **72***a* such that the radial ridge face **84***a* is radially offset from the radial flange face **72***a*. In that case, one or both the CMC skins **74***a*/**74***b* may be draped over the radial ridge face **84***a* so that the open ends of the cells **80***a* are covered.
(28) Unlike a filler material that may be used only in the space where fiber plies turn, the base portion **82** of the cellular core **80** extends in the platform **62**, thereby anchoring the flange **72**. In this regard, the base portion **82** of the cellular core **80** defines an axial length (L) in the platform **62** and the ridge **84** defines a radial thickness (R) at the flange **72**, and the axial length (L) is greater than the radial thickness (R). For instance, L is greater than R by a factor of at least two.
(29) The cellular core **80** of the examples herein may be formed of a material selected from a honeycomb, a foam, a ceramic felt, a 3-D fabric, a monolithic ceramic grid, or combinations thereof. For instance, the cellular core **80** above with the rectangular cells **80***a* may be formed from a layup of 2-D ceramic fabric that is constructed into the honeycomb shape and then densified with ceramic matrix. If not formed to net shape, the cellular core **80** may be machined to the desired profile. Alternatively, the cellar core **80** is a foam **86** with cells **86***a* as shown in FIG. **5**; a ceramic felt **88** with cells **88***a* as shown in FIG. **6**; a 3-D fabric **90** with cells **90***a* (between fiber tows) as shown in FIG. **7**; or a monolithic ceramic grid **92** with cells **92***a* as shown in FIG. **8**. In further examples, the foam **86** is a ceramic foam or reticulated vitreous carbon foam.
(30) As indicated previously, the cells **80***a* may be void (empty). However, as shown in FIG. **9**, the cells **80***a* may alternatively include a filler material **94** that fully or partially fills the volume of the cells **80***a*. For example, the filler material **94** is a monolithic ceramic or a fibrous ceramic. The filler material **94** may serve to reinforce the cellular core **80**, thus providing additional mechanical properties to the platform **62** and/or flange **72**. As will be appreciated, all of the cells **80***a* need not

include the filler material **94**, and the filler material **94** may be provided selectively in only the cells **80***a* in the flange **72**.
(31) In the previous examples, the flange **72** is configured as a "T" joint in that the platform **62** extends both fore and aft of the flange **72**, i.e., the flange **72** is offset from the edges of the platform **62**. As shown in FIG. **10**, the flange **72** may alternatively be configured as an "L" joint in which the platform **62** extends only fore or only aft of the flange **72**. In this case, the third CMC skin **74***c* curves radially and forms an edge face **62***a* of the platform **62**, i.e., the flange **72** is situated at the edge of the platform **62**. Optionally, the corner region **95** delimited by dashed lines may include a filler material made of additional CMC plies, a noodle (i.e., a bundle of fiber tows), or a noodle that is overwrapped with additional CMC plies (although the filler material may exceed the depicted bounds of the corner region **95**).
(32) FIG. **11** depicts a method for fabricating the airfoil **60** of the prior examples. At stage (a) a core blank **96** made of the cellular material is provided. For instance, the core blank **96** is selected from a honeycomb, a foam, a ceramic felt, a 3-D fabric, a monolithic ceramic grid, or combinations thereof, as also discussed above. The core blank **96** may be pre-formed as a block, for example. Techniques for fabricating the core blank **96** are not particularly limited and may include, but are not limited to, ply layup, 3-D printing, 3-D weaving, or milling or ultrasonic impact machined monolithic ceramic.
(33) At stage (b) the core blank **96** is shaped into the cellular core **80**. For instance, the shaping includes machining or cutting the core blank **96** to the desired geometry of the cellular core **80**, including forming the afore-mentioned ridge **84**. At stage (c) a fiber preform **98** is formed by laying-up ceramic fiber ply skins **74***a*/**74***b*/**74***c* (i.e., the fiber plies prior to densification to form the CMC skins **74***a*/**74***b*/**74***c*) on the cellular core **80** such that the cellular core **80** is sandwiched between the skins **74***a*/**74***b*/**74***c*. At stage (d) the fiber preform **98** is densified with a ceramic matrix to form the airfoil **60** at stage (e). For instance, although not limited, the densification may include, polymer infiltration and pyrolysis, slurry infiltration, melt infiltration, or chemical vapor infiltration. Machining or other finishing process may be conducted after densification.
(34) The cellular core **80** facilitates densification in that the cells **80***a* of the core **80**, to the extent they are open, provide pathways for flow of ceramic matrix material or precursor material, enabling full densification of the fiber ply skins **74***a*/**74***b*/**74***c*. In this manner, issues of infiltration through a thick wall for densification are avoided, yet the platform **62** and flange **72** can still be of substantial thickness. Of course, if the cells are closed or pre-filled with the filler material **94**, such pathways may be limited. In some instances, it may be desirable to control or limit flow through the cells **80***a* during densification. In this regard, the filler material **94** may be used to limit or control flow and/or a densification process may be selected for tailoring flow. As an example, chemical vapor infiltration may not infiltrate as readily as slurry or melt infiltration and may be used in conjunction with the filler material **94** to reduce flow into or through the cells **80***a*.
(35) Although a combination of features is shown in the illustrated examples, not all of them need to be combined to realize the benefits of various embodiments of this disclosure. In other words, a system designed according to an embodiment of this disclosure will not necessarily include all of the features shown in any one of the Figures or all of the portions schematically shown in the Figures. Moreover, selected features of one example embodiment may be combined with selected features of other example embodiments.
(36) The preceding description is exemplary rather than limiting in nature. Variations and modifications to the disclosed examples may become apparent to those skilled in the art that do not necessarily depart from this disclosure. The scope of legal protection given to this disclosure can only be determined by studying the following claims.

## Claims

1. An airfoil for a gas turbine engine comprising: an airfoil section; and a platform having a non-gaspath side, a flange extending from the non-gaspath side, and a gaspath side from which the airfoil section extends, the flange being comprised of a sandwich composite including first and second ceramic matrix composite (CMC) skins each including at least one 2-D ceramic fiber ply, and a cellular ceramic core disposed between the first and second CMC skins, and the cellular ceramic core is selected from the group consisting of a ceramic honeycomb, a ceramic foam, a ceramic felt, a monolithic ceramic grid, and combinations thereof; wherein the first and second CMC skins include, respectively, first and second radially upturned tabs extending in the flange, the cellular core including a base portion extending in the platform adjacent the flange and a ridge radially protruding from the base portion and extending between the first and second radially upturned tabs, the base portion having a maximum axial length in the platform and the ridge having a maximum radial thickness at the flange, and the axial length is greater than the radial thickness by a factor of at least 2.
2. The airfoil as recited in claim 1, wherein the sandwich composite includes a third CMC skin including at least one 2-D ceramic fiber ply on the gaspath side of the platform, with the cellular ceramic core being radially disposed between the third CMC skin and each of the first and second CMC skins.
3. The airfoil as recited in claim 1, wherein the flange defines a radial flange face, and the ridge defines a radial ridge face proximate the radial flange face.
4. The airfoil as recited in claim 1, wherein the first radially upturned tab is axially forward of the second radially upturned tab.
5. The airfoil as recited in claim 1, wherein the cellular ceramic core is selected from the group consisting of the ceramic honeycomb, the ceramic foam, the monolithic ceramic grid, and combinations thereof.
6. The airfoil as recited in claim 1, wherein the cellular ceramic core includes cells that are void.
7. The airfoil as recited in claim 1, wherein the cellular ceramic core is the ceramic honeycomb including honeycomb side walls that define and circumscribe uniformly-shaped cells.
8. A gas turbine engine comprising: a compressor section; a combustor in fluid communication with the compressor section; and a turbine section in fluid communication with the combustor, the turbine section having an airfoil including an airfoil section, and a platform having a non-gaspath side, a flange extending from the non-gaspath side, and a gaspath side from which the airfoil section extends, the flange being comprised of a sandwich composite including first and second ceramic matrix composite (CMC) skins each including at least one 2-D ceramic fiber ply, and a cellular core disposed between the first and second CMC skins, the first and second CMC skins including, respectively, first and second radially upturned tabs extending in the flange, the cellular core including a base portion extending in the platform adjacent the flange and a ridge radially protruding from the base portion and extending between the first and second radially upturned tabs, the base portion having a maximum axial length in the platform and the ridge having a maximum radial thickness at the flange, and the axial length is greater than the radial thickness by a factor of at least 2.
9. The gas turbine engine as recited in claim 8, wherein the sandwich composite includes a third CMC skin including at least one 2-D ceramic fiber ply on the gaspath side of the platform, with the cellular core being radially disposed between the third CMC skin and each of the first and second CMC skins.
10. The gas turbine as recited in claim 8, wherein the cellular core is selected from the group consisting of a ceramic honeycomb, a ceramic foam, a ceramic felt, a monolithic ceramic grid, and combinations thereof.
11. The gas turbine as recited in claim 8, wherein the flange defines a radial flange face, and the ridge defines a radial ridge face that has cells that open at the radial flange face.

12. The gas turbine as recited in claim 11, wherein the radial ridge face is flush with the radial flange face.

13. A method for fabricating an airfoil for a gas turbine engine, the method comprising: providing a core blank made of a cellular material; shaping the core blank into a cellular ceramic core; forming a fiber preform that has an airfoil section and a platform by laying-up first and second ceramic fiber ply skins on the cellular ceramic core such that in a flange on the platform the cellular ceramic core is sandwiched between the first and second ceramic fiber ply skins, the first and second ceramic fiber ply skins each include at least one 2-D ceramic fiber ply, the cellular ceramic core is selected from the group consisting of a ceramic honeycomb, a ceramic foam, a ceramic felt, a monolithic ceramic grid, and combinations thereof; densifying the fiber preform with a ceramic matrix to make the first and second ceramic fiber ply skins into first and second ceramic matrix composite (CMC) skins; and wherein the first and second CMC skins include, respectively, first and second radially upturned tabs extending in the flange, the cellular core including a base portion extending in the platform adjacent the flange and a ridge radially protruding from the base portion and extending between the first and second radially upturned tabs, the base portion having a maximum axial length in the platform and the ridge having a maximum radial thickness at the flange, and the axial length is greater than the radial thickness by a factor of at least 2.

14. The method as recited in claim 13, wherein the shaping includes machining the core blank.