CLAIMS

What is claimed is:

1. An article, comprising:

a core having a first hardness; and

a surface on the core, the surface including a plurality of geometric features having a second, greater hardness and defining a surface porosity by area percent (SP) and a surface solidity by area percent (SS), the surface including a ratio of SS/SP that is 1.8 or greater, the plurality of geometric features and the ratio establishing the surface to be hydrophobic such that the surface would not be hydrophobic in absence of the plurality of geometric features or the ratio, and the second, greater hardness and the ratio establishing an erosion rate of the surface that is equal to or less than an erosion rate of the core under identical erosion conditions such that the erosion rate of the surface would not be equal to or less than an erosion rate of the core in absence of the second, greater hardness or the ratio.

2. The article as recited in claim 1, wherein the plurality of geometric features include a plurality of cylindrical elements.

3. The article as recited in claim 1, wherein each of the plurality of geometric features extends along a respective central axis from a base at the core to a free end, each of the plurality of geometric features including a height (h) extending from the base to the free end and a maximum width (w) extending perpendicular to the height to define an aspect ratio w/h that is 0.004-4.

4. The article as recited in claim 3, wherein the plurality of geometric features include non-equivalent aspect ratios.

5. The article as recited in claim 1, wherein each of the plurality of geometric features extends along a respective central axis from a base at the core to a free end, each of the plurality of geometric features including a cross-section taken perpendicular to the central axis, and the cross-section varies in area along the central axis.

6. The article as recited in claim 1, wherein each of the plurality of geometric features extends along a respective central axis from a base at the core to a free end, and each of the plurality of geometric features includes an enlarged head at the free end.

7. The article as recited in claim 1, wherein each of the plurality of geometric features extends along a respective central axis from a base at the core to a free end, the base defining a reference plane and the central axis being at a non-perpendicular angle to the reference plane.

8. The article as recited in claim 7, wherein the non-perpendicular angle is less than 90° and greater than or equal to 20°.

9. The article as recited in claim 7, wherein the non-perpendicular angles are non-equivalent.

10. The article as recited in claim 1, wherein each of the plurality of geometric features extends along a respective central axis from a base at the core to a free end, the base defining a reference plane and the free end having a surface that is sloped relative to the reference plane.

11. The article as recited in claim 1, wherein the ratio is 15.7 or less.

12. The article as recited in claim 1, wherein the plurality of geometric features are made of a metallic material.

13. The article as recited in claim 1, wherein the plurality of geometric features are made of a material selected from the group consisting of polymer material, ceramic material, intermetallic material and combinations thereof.

14. The article as recited in claim 1, wherein the core is made of a material selected from the group consisting of polymer material, metallic material, ceramic material and combinations thereof.

15. The article as recited in claim 1, wherein the core and the plurality of geometric features are made of respective materials that have equivalent material composition.

16. The article as recited in claim 1, wherein the core has an airfoil shape.

17. A gas turbine engine comprising:

an article including a core having a first hardness and a surface on the core, the surface including a plurality of geometric features having a second, greater hardness and defining a surface porosity by area percent (SP) and a surface solidity by area percent (SS), the surface including a ratio of SS/SP that is 1.8 or greater, the plurality of geometric features and the ratio establishing the surface to be hydrophobic such that the surface would not be hydrophobic in absence of the plurality of geometric features or the ratio, and the second, greater hardness and the ratio establishing an erosion rate of the surface that is equal to or less than an erosion rate of the core under identical erosion conditions such that the erosion rate of the surface would not be equal to or less than an erosion rate of the core in absence of the second, greater hardness or the ratio.

18. The gas turbine engine as recited in claim 17, including a compressor section, a combustor in fluid communication with the compressor section and a turbine section in fluid communication with the combustor.

19. A method of providing erosion protection and hydrophobicity in an article, the method comprising:

in an article that has a core and a surface on the core, establishing the surface to be hydrophobic by providing the surface with a plurality of geometric features defining a surface porosity by area percent (SP) and a surface solidity by area percent (SS) such that a ratio of SS/SP that is 1.8 or greater, wherein the surface would not be hydrophobic in absence of the plurality of geometric features or the ratio; and

establishing the surface to have an erosion rate that is equal to or less than an erosion rate of the core under identical erosion conditions by providing the ratio and providing the core with a first hardness and the plurality of geometric surface features with a second, greater hardness, wherein the erosion rate of the surface would not be equal to or less than an erosion rate of the core in absence of the second, greater hardness or the ratio.

20. The method as recited in claim 19, including establishing the surface to be hydrophobic such that the ratio is 15.7 or less.

CLAIMS

What is claimed is:

1. An article, comprising:

a core having a first hardness; and

a surface on the core, the surface including a plurality of geometric features having a second, greater hardness and defining a surface porosity by area percent (SP) and a surface solidity by area percent (SS), the surface including a ratio of SS/SP that is 1.8 or greater, the plurality of geometric features and the ratio establishing the surface to be hydrophobic such that the surface would not be hydrophobic in absence of the plurality of geometric features or the ratio, and the second, greater hardness and the ratio establishing an erosion rate of the surface that is equal to or less than an erosion rate of the core under identical erosion conditions such that the erosion rate of the surface would not be equal to or less than an erosion rate of the core in absence of the second, greater hardness or the ratio, wherein each of the plurality of geometric features extends along a respective central axis from a base at the core to a free end, the base defining a reference plane and the central axis being at a non-perpendicular angle to the reference plane, and the non-perpendicular angles are non-equivalent.

2. The article as recited in claim 1, wherein the plurality of geometric features include a plurality of cylindrical elements.

3. The article as recited in claim 1, wherein each of the plurality of geometric features extends along a respective central axis from a base at the core to a free end, each of the plurality of geometric features including a height (h) extending from the base to the free end and a maximum width (w) extending perpendicular to the height to define an aspect ratio w/h that is 0.004-4.

4. The article as recited in claim 3, wherein the plurality of geometric features include non-equivalent aspect ratios.

5. The article as recited in claim 1, wherein each of the plurality of geometric features includes a cross-section taken perpendicular to the central axis, and the cross-section varies in area along the central axis.

6. The article as recited in claim 1, wherein each of the plurality of geometric features includes an enlarged head at the free end.

7. The article as recited in claim 1, wherein the non-perpendicular angle is less than 90° and greater than or equal to 20°.

8. The article as recited in claim 1, wherein the free end has a surface that is sloped relative to the reference plane.

9. The article as recited in claim 1, wherein the ratio is 15.7 or less.

10. The article as recited in claim 1, wherein the plurality of geometric features are made of a metallic material.

11. The article as recited in claim 1, wherein the plurality of geometric features are made of a material selected from the group consisting of polymer material, ceramic material, intermetallic material and combinations thereof.

12. The article as recited in claim 1, wherein the core is made of a material selected from the group consisting of polymer material, metallic material, ceramic material and combinations thereof.

13. The article as recited in claim 1, wherein the core and the plurality of geometric features are made of respective materials that have equivalent material composition.

14. The article as recited in claim 1, wherein the core has an airfoil shape.

15. A gas turbine engine comprising:

an article including a core having a first hardness and a surface on the core, the surface including a plurality of geometric features having a second, greater hardness and defining a surface porosity by area percent (SP) and a surface solidity by area percent (SS), the surface including a ratio of SS/SP that is 1.8 or greater, the plurality of geometric features and the ratio establishing the surface to be hydrophobic such that the surface would not be hydrophobic in absence of the plurality of geometric features or the ratio, and the second, greater hardness and the ratio establishing an erosion rate of the surface that is equal to or less than an erosion rate of the core under identical erosion conditions such that the erosion rate of the surface would not be equal to or less than an erosion rate of the core in absence of the second, greater hardness or the ratio, wherein each of the plurality of geometric features extends along a respective central axis from a base at the core to a free end, the base defining a reference plane and the central axis being at a non-perpendicular angle to the reference plane, and the non-perpendicular angles are non-equivalent.

16. The gas turbine engine as recited in claim 15, including a compressor section, a combustor in fluid communication with the compressor section and a turbine section in fluid communication with the combustor.

17. A method of providing erosion protection and hydrophobicity in an article, the method comprising:

in an article that has a core and a surface on the core, establishing the surface to be hydrophobic by providing the surface with a plurality of geometric features defining a surface porosity by area percent (SP) and a surface solidity by area percent (SS) such that a ratio of SS/SP that is 1.8 or greater, wherein the surface would not be hydrophobic in absence of the plurality of geometric features or the ratio; and

establishing the surface to have an erosion rate that is equal to or less than an erosion rate of the core under identical erosion conditions by providing the ratio and providing the core with a first hardness and the plurality of geometric surface features with a second, greater hardness, wherein the erosion rate of the surface would not be equal to or less than an erosion rate of the core in absence of the second, greater hardness or the ratio, wherein each of the plurality of geometric features extends along a respective central axis from a base at the core to a free end, the base defining a reference plane and the central axis being at a non-perpendicular angle to the reference plane, and the non-perpendicular angles are non-equivalent.

18. The method as recited in claim 17, including establishing the surface to be hydrophobic such that the ratio is 15.7 or less.