CLAIMS:

1. An article comprising:

a substrate;

a plurality of cooling holes formed in the substrate;

a first array of features on a surface of the substrate at a first location, wherein the first array comprises a first pattern comprising a grid of grooves, wherein each of the grooves does not extend through the substrate, wherein the grid of grooves comprises a first plurality of grooves formed substantially parallel to each other and a second plurality of grooves formed substantially parallel to each other, wherein the grooves from the first plurality of grooves intersect grooves from the second plurality of grooves, wherein the grid of grooves defines a plurality of plateaus in the substrate, and wherein a respective cooling hole of the plurality of cooling holes is formed in a respective plateau of the plurality of plateaus;

a second array of features on the surface of the substrate at a second location, wherein the second array comprises a second pattern different than the first pattern, wherein the first location is predicted to experience a first level of thermal stress and the second location is predicted to experience a second level of thermal stress different than the first level of thermal stress; and

a thermal barrier coating ~~formed~~ on the substrate, on the first array of features, including on the grid of grooves and the plurality of plateaus, and on the second array of features.

2. The article of claim 1, wherein the first array of features comprises ~~an array of~~ at least one of a grid of linear grooves~~,~~ or a grid of sinusoidal grooves, ~~circular depressions, ellipsoidal depressions, or hexagonal depressions,~~ and wherein the second array of features comprises an array of at least one of linear grooves, sinusoidal grooves, circular depressions, ellipsoidal depressions, or hexagonal depressions.

3. The article of claim 1~~2~~, wherein the first pattern comprises at least one of a depth of the grooves~~features~~, a width~~size~~ of the grooves~~features~~, a pitch between the grooves~~features~~, or a shape of the grooves~~features~~, and wherein the second pattern comprises at least one of a depth of the features, a size of the features, a pitch between the features, or a shape of the features.

4. The article of claim 3, wherein a first groove~~feature~~ in the grid~~first array~~ of grooves~~features~~ comprises a first depth, and a second groove~~feature~~ in the grid~~first array~~ of grooves~~features~~ comprises a second depth different than the first depth.

5. The article of claim 3, wherein a first groove~~feature~~ in the grid~~first array~~ of grooves~~features~~ comprises a first width~~size~~, and a second groove~~feature~~ in the grid~~first array~~ of grooves~~features~~ comprises a second width~~size~~ different than the first width~~size~~.

~~6. The article of claim 3, wherein a first feature in the first array of features comprises a first shape, and a second feature in the first array of features comprises a second shape different than the first shape.~~

67. The article of claim 3, wherein the grid~~first array~~ of grooves~~features~~ comprises a first groove~~feature~~, a second groove~~feature~~, a third groove~~feature~~, and a fourth groove~~feature~~, and wherein a first pitch between the first groove~~feature~~ and the second groove~~feature~~ is different than a second pitch between the third groove~~feature~~ and the fourth groove~~feature~~.

78. The article of claim 1, wherein the thermal barrier coating comprises:

a bond coat on~~formed over~~ the substrate, the first array of features, and the second array of features; and

a thermally insulative layer on~~formed over~~ the bond coat, wherein the thermally insulative layer comprises a plurality of vertically oriented cracks.

89. The article of claim 1, wherein the thermal barrier coating comprises:

a bond coat on~~formed over~~ the substrate, the first array of features, and the second array of features;

a first thermally insulative layer comprising a first porosity on~~and formed over~~ the bond coat; and

a second thermally insulative layer comprising a second porosity on~~and formed over~~ the first thermally insulative layer, wherein the first porosity is less than the second porosity.

9~~10~~. The article of claim 1, wherein the thermal barrier coating comprises:

a first thermally insulative layer on~~formed over~~ the first array of features, wherein the first thermally insulative layer comprises a first composition; and

a second thermally insulative layer on~~formed over~~ the second array of features, wherein the second thermally insulative layer comprises a second composition different than the first composition.

10~~11~~. A method comprising:

forming a first array of features on a surface of a substrate at a first location, wherein the first location is selected based on a first predicted level of thermal stress, ~~and~~ wherein the first array of features comprises a first pattern comprising a grid of grooves, wherein each of the grooves does not extend through the substrate, wherein the grid of grooves comprises a first plurality of grooves formed substantially parallel to each other and a second plurality of grooves formed substantially parallel to each other, wherein the grooves from the first plurality of grooves intersect grooves from the second plurality of grooves, wherein the grid of grooves defines a plurality of plateaus in the substrate, and wherein a respective cooling hole of a plurality of cooling holes is formed in a respective plateau of the plurality of plateaus;

forming a second array of features on the surface of the substrate at a second location, wherein the second location is selected based on a second predicted level of thermal stress, and wherein the second array of features comprises a second pattern different than the first pattern; and

forming a thermal barrier coating over the substrate, over the first array of features, including on the grid of grooves and the plurality of plateaus, and over the second array of features.

1112. The method of claim 1011, wherein the first array of features comprises ~~an array of~~ at least one of a grid of linear grooves~~,~~ or a grid of sinusoidal grooves, ~~circular depressions, ellipsoidal depressions, or hexagonal depressions,~~ and wherein the second array of features comprises an array of at least one of linear grooves, sinusoidal grooves, circular depressions, ellipsoidal depressions, or hexagonal depressions.

1213. The method of claim 1011, wherein the first pattern comprises at least one of a depth of the grooves~~features~~, a width~~size~~ of the grooves~~features~~, a pitch between the grooves~~features~~, or a shape of the grooves~~features~~, and wherein the second pattern comprises at least one of a depth of the features, a size of the features, a pitch between the features, or a shape of the features.

1314. The method of claim 1011, wherein a first groovefeature in the gridfirst array of groovesfeatures comprises a first depth, and a second groovefeature in the gridfirst array of groovesfeatures comprises a second depth different than the first depth.

1415. The method of claim 1011, wherein a first groovefeature in the gridfirst array of groovesfeatures comprises a first widthsize, and a second groovefeature in the gridfirst array of groovesfeatures comprises a second widthsize different than the first widthsize.

16. The method of claim 11, wherein a first feature in the first array of features comprises a first shape, and a second feature in the first array of features comprises a second shape different than the first shape.

1517. The method of claim 1011, wherein the gridfirst array of groovesfeatures comprises a first groovefeature, a second groovefeature, a third groovefeature, and a fourth groovefeature, and wherein a first pitch between the first groovefeature and the second groovefeature is different than a second pitch between the third groovefeature and the fourth groovefeature.

1618. The method of claim 1011, wherein the first predicted level of thermal stress and the second predicted level of thermal stress are predicted based on experimental observations.

1719. The method of claim 1011, wherein forming the thermal barrier coating over the substrate, over the first array of features, including on the grid of grooves and the plurality of plateaus, and over the second array of features comprises:

forming a bond coat over the substrate, the first array of features, and the second array of features; and

forming a thermally insulative layer over the bond coat, wherein the thermally insulative layer comprises a plurality of vertically oriented cracks.

1820. The method of claim 1011, wherein forming the thermal barrier coating over the substrate, over the first array of features, including on the grid of grooves and the plurality of plateaus, and over the second array of features comprises:

forming a bond coat over the substrate, the first array of features, and the second array of features;

forming a first thermally insulative layer comprising a first porosity over the bond coat; and

forming a second thermally insulative layer comprising a second porosity over the first thermally insulative layer, wherein the first porosity is less than the second porosity.

1921. The method of claim 1011, wherein forming the thermal barrier coating over the substrate, over the first array of features, including on the grid of grooves and the plurality of plateaus, and over the second array of features comprises:

forming a first thermally insulative layer over the first array of features, wherein the first thermally insulative layer comprises a first composition; and

forming a second thermally insulative layer over the second array of features, wherein the second thermally insulative layer comprises a second composition different than the first composition.