configurable cooling assembly for use in conducting heat away from HSMs in the proximity of a bonded repair.

According to one aspect, there is provided a method of managing the temperature of heat sensitive material located near a repair patch being thermally cured on a composite skin using a heating blanket. The method includes configuring an assembly of thermally conductive cooling blocks to fit within a space between the heating blanket and the heat sensitive material. Certain of the cooling blocks comprise at least one through-hole allowing air to pass therethrough. The assembly of cooling blocks is configured to comprise: at least one layer of cooling blocks with no through-holes; at least one layer of cooling blocks with one through-holes; at least one layer of cooling blocks with more than one through-holes. The method further includes installing the assembly of thermally conductive cooling blocks against the skin within the space, forming a heat sink that conducts a portion of heat out of the composite skin away from the heat sensitive material, wherein the layer of cooling block with no through-holes is closest to the composite skin.

According to ~~one aspect~~the present disclosure, an apparatus is provided for cooling a structure, comprising an assembly of configurable, thermally conductive cooling blocks. The cooling blocks are configured to be placed against a surface of the structure and fit within a predetermined volume of space adjacent to the structure.

According to ~~another aspect~~the present disclosure, an apparatus is provided for preventing overheating of heat sensitive materials near a repair patch being thermally cured on a composite skin by a heat source. The apparatus comprises an assembly of thermally conductive cooling blocks configured to be placed against the composite skin for conducting heat away from the composite skin between the heat sensitive material and the heat source.

According to ~~still~~ another aspect, there is provided a method ~~is provided~~ of managing the temperature of heat sensitive materials located near a repair patch being thermally cured on a composite skin using a heating blanket. The method comprises configuring an assembly of thermally conductive cooling blocks to fit within a space between the heat blanket and the heat sensitive material, and installing the assembly of thermally conductive cooling blocks against the skin within the space, forming a heat sink that conducts a portion of heat out of the composite skin away from the heat sensitive material.

One of the advantages of the cooling assembly is that it is simple, passive, may be installed in tight spaces and is readily configurable to suit unusual or complex geometries of a structure requiring cooling. Another advantage of the cooling assembly is that it is reusable and can be reconfigured to achieve different heat sink shapes and levels of cooling required in different applications. A further advantage of the cooling assembly is that it avoids the need for interrupting thermal curing of a composite patch when there is a risk of overheating of the adjacent HSMs.

The features, functions, and advantages can be achieved independently in various embodiments of the present disclosure

CLAIMS:

~~What is claimed is:~~

~~1. Apparatus for cooling a structure (20), comprising:~~

~~an assembly (36) of configurable, thermally conductive cooling blocks (38) configured to be placed against a surface (20a) of the structure (20) and fit within a predetermined volume of space (34) adjacent the structure (20).~~

~~2. The apparatus of claim 1, wherein the assembly (36) includes a plurality of the cooling blocks (38) arranged in a three-dimensional array.~~

~~3. The apparatus of claim 1 or 2, wherein each of the cooling blocks (38) is formed from one of:~~

~~copper, and~~

~~aluminum.~~

~~4. The apparatus of claim 1, 2 or 3, wherein the cooling blocks (38) include interconnections (54, 56, 58, 60) coupling the cooling blocks (38) together.~~

~~5. The apparatus of claim 4, wherein the interconnections (54, 56, 58, 60) are releasable to allow the shape of the assembly (36) of the cooling blocks (38) to be reconfigured.~~

~~6. The apparatus of claim 4 or 5, wherein the interconnections (54, 56, 58, 60) include one of:~~

~~ways (56) and gibs (54) formed in each of the cooling blocks (38),~~

~~pins (60) between the cooling blocks (38),~~

~~snap fit fasteners (60),~~

~~magnets (58), and~~

~~a conductive adhesive between the cooling blocks.~~

~~7. The apparatus of any one of claims 1 to 6, wherein at least certain of the cooling blocks (38) include at least one through-hole (40) allowing passage of air (50) therethrough.~~

~~8. The apparatus of any one of claims 1 to 7, wherein the assembly (36) includes a plurality of the cooling blocks (38) arranged in a row and having through-holes (40) therein aligned to form an air passageway (42) through the cooling blocks (38) in the row.~~

~~9. The apparatus of claim 8, including a fan (52) configured to force air (50) through the air passageway (42).~~

~~10. A method of managing the temperature of heat sensitive materials (24) located near a repair patch being thermally cured on a composite skin (20) using a heating blanket (28), comprising:~~

~~configuring an assembly (36) of thermally conductive cooling blocks (38) to fit within a space (34) between the heating blanket (28) and the heat sensitive material (24); and~~

~~installing the assembly (36) of thermally conductive cooling blocks (38) against the skin (20) within the space (34).~~

~~11. The method of claim 10, wherein the configuring includes:~~

~~placing the cooling blocks (39) in an arrangement of rows and columns, and~~

~~holding the cooling blocks (38) in the arrangement.~~

~~12. The method of claim 10 or 11, wherein the configuring includes forming through-holes (40) in at least certain of the cooling blocks (38) allowing air (50) to pass therethrough.~~

~~13. The method of claim 12, including drawing heat away from the cooling blocks (38) by forcing air (50) through the through-holes (40).~~

~~14. The method of any one of claims 10 to 13, further comprising:~~

~~disassembling the assembly (36) of the cooling blocks (38); and~~

~~reassembling the cooling blocks (38) in another configuration.~~

1. A method of managing the temperature of heat sensitive material located near a repair patch being thermally cured on a composite skin using a heating blanket, the method comprising:

configuring an assembly of thermally conductive cooling blocks to fit within a space between the heating blanket and the heat sensitive material, wherein certain of the cooling blocks comprise at least one through-hole allowing air to pass therethrough, and wherein the assembly of cooling blocks is configured to comprise:

at least one layer of cooling blocks with no through-holes;

at least one layer of cooling blocks with one through-holes;

at least one layer of cooling blocks with more than one through-holes; and

installing the assembly of thermally conductive cooling blocks against the skin within the space, forming a heat sink that conducts a portion of heat out of the composite skin away from the heat sensitive material, wherein the layer of cooling block with no through-holes is closest to the composite skin.

2. A method of managing the temperature of heat sensitive material located near a repair patch being thermally cured on a composite skin using a heating blanket, the method comprising:

configuring an assembly of thermally conductive cooling blocks to fit within a space between the heating blanket and the heat sensitive material; and

installing the assembly of thermally conductive cooling blocks against the skin within the space, forming a heat sink that conducts a portion of heat out of the composite skin away from the heat sensitive material.

3. The method of claim 2, wherein the configuring includes:

placing the cooling blocks in an arrangement of rows and columns, and

holding the cooling blocks in the arrangement.

4. The method of claim 2, wherein the configuring includes forming through-holes in at least certain of the cooling blocks allowing air to pass therethrough.

5. The method of claim 4, including drawing heat away from the cooling blocks by forcing air through the through-holes.

6. The method of claim 4, further comprising arranging the cooling block such the through-holes are aligned to form continuous air passageways through the cooling block assembly.

7. The method of claim 4, further comprising arranging the cooling blocks in a number of layers, wherein cooling blocks in layers closest to the composite skin have a fewest number of through-holes, and cooling blocks in layers farthest from the composite skin have a greatest number of through-holes.

8. The method of claim 2, further comprising:

disassembling the assembly of the cooling blocks; and

reassembling the cooling blocks in another configuration.

9. The method of claim 2, wherein the cooling blocks are formed of one of:

copper, and

aluminum.

10. The method of claim 2, wherein the cooling blocks include interconnections coupling the cooling blocks together, and wherein the interconnections are releasable to allow the shape of the assembly of the cooling blocks to be reconfigured.

11. The method of claim 10, wherein the interconnections include one of:

ways and gibs formed in each of the cooling blocks,

pins between the cooling blocks,

snap fit fasteners,

magnets, and

a conductive adhesive between the cooling blocks.

12. The method of claim 2, further comprising arranging the cooling blocks to absorb heat radiated by the heating blanket.

13. The method of claim 2, wherein each block comprises one or more recessed magnets, wherein magnets in adjacent cooling blocks are aligned with and attract each other, holding the cooling blocks together in the assembly by magnetic forces.

14. The method of claim 2, wherein each block comprises one or more raised locating balls on a bottom surface and one or more indexing recesses on a top surface, wherein the indexing recesses are configured to receive locating balls on another block to located and position layers of cooling bocks relative to each other.

15. A method of managing the temperature of heat sensitive material, the method comprising:

configuring an assembly of thermally conductive cooling blocks to fit within a predetermined volume of space between a heat source and the heat sensitive material, wherein the heat source and heat sensitive material are connected by a physical structure; and

installing the assembly of thermally conductive cooling blocks against the physical structure within the space, forming a heat sink that conducts a portion of heat out of the physical structure away from the heat sensitive material.

16. The method of claim 15, wherein the configuring includes forming through-holes in at least certain of the cooling blocks allowing air to pass therethrough.

17. The method of claim 16, including drawing heat away from the cooling blocks by forcing air through the through-holes.

18. The method of claim 16, further comprising arranging the cooling blocks in a number of layers, wherein cooling blocks in layers closest to the composite skin have a fewest number of through-holes, and cooling blocks in layers farthest from the composite skin have a greatest number of through-holes.

19. The method of claim 15, wherein the cooling blocks include interconnections coupling the cooling blocks together, and wherein the interconnections are releasable to allow the shape of the assembly of the cooling blocks to be reconfigured.

20. The method of claim 15, further comprising arranging the assembly of cooling blocks to absorb heat radiated by the heating blanket.