and solid conductive (e.g. copper) foil, which is installed either with a heat blanket or autoclave cure process. Although this solution is effective, it has some drawbacks. For instance, the hot bond repair requires taking the aircraft out of service, bringing it to a service center, and draining all fuel out of the fuel tanks, in order to perform the hot-bond repair. Only after fuel drainage can technicians apply the patch, and then must wait for the patch to cure, which can take an additional 4-8 hours, depending on the material. This approach is appropriate for in-factory repairs or repairs during regularly scheduled aircraft maintenance, when the aircraft is intended to be out of service, but a quicker solution is more desirable for in-service repairs in order to allow the airplane to get quickly back into service until a permanent repair can be scheduled.

There thus exists a need for an inexpensive and robust technique for temporarily repairing outer composite aircraft skins that utilize copper foil along fastener rows for lightning strike protection that have been altered by lightning strikes or in some other way, in order to maintain the desired lightning prevention system to help divert lightning currents away from substructures.

SUMMARY

In accordance with one embodiment thereof, the present disclosure provides a system comprising a composite structure and a repair apparatus for an electrically conductive layer of the composite structure. The system includes a dielectric layer, having a perimeter, secured to the structure, and a conductive layer, secured with a pressure-sensitive adhesive over the dielectric layer and to the structure around an entirety of the perimeter of the dielectric layer, wherein the adhesive in the perimeter region of the conductive layer comprises scores or grooves.

The present disclosure also provides a method for temporarily repairing a conductive composite panel having a damaged area near a metal fastener. The method includes preparing a surface of the panel in the region of the damaged area and the fastener, affixing a dielectric material to the panel, and affixing a conductive patch to the dielectric material and the panel. The dielectric material is affixed with an adhesive, the dielectric material covering the damaged area and the fastener. The conductive patch is affixed with an adhesive, the conductive patch entirely covering the dielectric material and defining a perimeter region in contact with the panel. The perimeter region of the conductive patch is treated to increase electrical conductivity between the panel and the conductive patch.

WHAT IS CLAIMED IS:

1. A system comprising a composite structure and a repair apparatus for an electrically conductive layer of said composite structure, the system comprising:

a dielectric layer, having a perimeter, secured to the structure; and

a conductive layer, secured with a pressure-sensitive adhesive over the dielectric layer and to the structure around an entirety of the perimeter of the dielectric layer, wherein the adhesive in the perimeter region of the conductive layer comprises scores or grooves.

2. The system in accordance with claim 1, wherein the dielectric layer has a thickness of 0.0508mm – 0.2032mm (2-8 mils) and a dielectric constant of about 2 to 5.

3. The system in accordance with claim 1 or 2, wherein the conductive layer has a thickness of from 0.2032mm - 0.3048mm (8-12 mils) and an equivalent conductivity of aluminum having a thickness of from 0.2032mm - 0.3048mm (8-12 mils).

4. The system in accordance with any one of claims 1 to 3, wherein the electrically conductive layer of the composite structure comprises a copper foil grid layer that is integrally included in the composite structure.

5. The system in accordance with any one of claims 1 to 4, where in the composite structure comprises a portion of an aircraft.

6. The system in accordance with claim 5, wherein the composite structure comprises a skin panel of the aircraft.

7. The system in accordance with any one of claims 1 to 6, further comprising a sealing composition, applied around a perimeter of the conductive layer.

8. The system in accordance with any one of claims 1 to 7, wherein the dielectric layer comprises polyester.

9. The system in accordance with any one of claims 1 to 8, wherein the pressure-sensitive adhesive is selected from the group consisting of acrylic and silicone.

10. A method for temporarily repairing a carbon fiber composite aircraft skin panel, comprising:

preparing a surface of the panel in a damaged region near a fastener;

affixing a dielectric material to the panel with a pressure-sensitive adhesive, the dielectric material covering the damaged area and the fastener; and

affixing a conductive patch to the dielectric material and the panel with a pressure-sensitive adhesive, the conductive patch entirely covering the dielectric material and defining a perimeter region in contact with the panel, wherein adhesive in the perimeter region of the conductive patch is scored to expose the conductive material in selected regions of the conductive patch prior to adhesion to the panel.

11. The method in accordance with claim 10, wherein preparing the surface of the panel comprises one or more of grinding, sanding, filling and chemically treating the panel surface prior to affixing the dielectric material.

12. The method in accordance with claim 10 or 11, wherein affixing the dielectric material to the panel comprises affixing a dielectric material having a thickness of 0.0508mm – 0.2032mm (2-8 mils) and a dielectric constant of about 2 to 5, and affixing the conductive patch comprises affixing a conductive patch having a thickness of from 0.2032mm – 0.3048mm (8-12 mils) and an equivalent conductivity of aluminum having a thickness of from 0.2032mm – 0.3048mm (8-12 mils).

13. The method in accordance with any one of claims 10 to 12, further comprising sealing outer perimeter edges of the conductive patch after affixing the patch to the panel.

14. The method in accordance with any one of claims 10 to 13, wherein the aircraft skin panel is one of a fuselage skin panel and a wing skin panel.