CLAIMS

1. A method comprising:

identifying a damaged area in an environmental barrier coating of an in-service component;

applying a restoration slurry to the damaged area of the environmental barrier coating, wherein the restoration slurry comprises a liquid carrier and a restoration coating material, and wherein the restoration coating material comprises at least two of mullite, a rare earth silicate, a rare earth oxide, alumina, zirconia, hafnia, $ZrSiO_4$, $HfSiO_4$, TiO_2, Ta_2O_5, carbon, boron oxide, borosilicate, alkali metal oxide, alkali earth metal oxide, silicon, silicon alloy, aluminum, boron, germanium, silica, barium strontium aluminosilicate, barium aluminosilicate, calcium aluminosilicate, magnesium aluminosilicate, or lithium aluminosilicate;

drying the restoration slurry to form a dried restoration slurry; and

heat treating the dried restoration slurry to cause a reaction between the at least two of mullite, the rare earth silicate, the rare earth oxide, alumina, zirconia, hafnia, $ZrSiO_4$, $HfSiO_4$, TiO_2, Ta_2O_5, carbon, boron oxide, borosilicate, alkali metal oxide, alkali earth metal oxide, silicon, silicon alloy, aluminum, boron, germanium, silica, barium strontium aluminosilicate, barium aluminosilicate, calcium aluminosilicate, magnesium aluminosilicate, or lithium aluminosilicate to form a restored portion of the environmental barrier coating comprising a glass phase.

2. The method of claim 1, further comprising preparing an exposed surface of the environmental barrier coating.

3. The method of claim 2, wherein preparing the environmental barrier coating, includes: removing a damaged area of the environmental barrier coating to reveal the exposed surface.

4. The method of claim 2, wherein preparing the environmental barrier coating comprises cleaning the exposed surface.

5. The method of any of claim 2, further comprising roughening the exposed surface.

6. The method of any of claim 2, wherein preparing the exposed surface of the environmental barrier coating further comprises masking around the damaged area to protect an adjacent undamaged portion of the environmental barrier coating not within the damaged area.

7. The method of any of claim 1, wherein applying the restoration slurry includes selectively applying the restoration slurry to the damaged area with respect to an area adjacent the damaged area.

8. The method of any of claim 1, further comprising applying a secondary coating to the environmental barrier coating within the damaged area after heat treating the dried restoration slurry.

9. The method of any of claim 1, further comprising finishing an outer surface of the environmental barrier coating including the restored portion.

10. The method of any of claim 1, wherein heat treating the dried restoration slurry causes a reaction between constituents of the restored portion to form a glass phase in the restored portion.

11. The method of any of claim 1, further comprising leaving the in-service component as part of an assembly of which the in-service component is a part throughout method.

12. The method of any of claim 1, wherein the restoration slurry further comprises a fugitive material, and wherein heat treating the dried restoration slurry evaporates or burns off the fugitive material evaporates to form porosity in the restored portion of the environmental barrier coating.

13. The method of any of claim 1, wherein the restoration slurry further comprises a pre-ceramic polymer.