WHAT IS CLAIMED IS:

1. A method comprising:

identifying a damaged area in ~~a ceramic matrix composite~~ an environmental barrier coating of an in-service component, wherein the environmental barrier coating is on a substrate of the in-service component;

applying a restoration slurry to the damaged area of the ~~ceramic matrix composite~~ environmental barrier coating, wherein the restoration slurry comprises a liquid carrier and a restoration coating material;

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

heat treating the dried restoration slurry to form a restored portion of the ~~ceramic matrix composite~~ environmental barrier coating.

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

3. The method of claim 2, wherein preparing the ~~ceramic matrix composite~~ environmental barrier coating~~,~~ includes~~:~~ at least one of:

removing a damaged area of the ~~ceramic matrix composite~~ environmental barrier coating to reveal the exposed surface~~.~~;

cleaning the exposed surface;

roughening the exposed surface; or

masking around the damaged area to protect an adjacent undamaged portion of the environmental barrier coating not within the damaged area.

~~4. The method of claim 2 or 3, wherein preparing the ceramic matrix composite coating comprises cleaning the exposed surface.~~

~~5. The method of any of claims 2 to 4, further comprising roughening the exposed surface;~~

~~6. The method of any of claims 2 to 5, wherein preparing the exposed surface of the ceramic matrix composite coating further comprises masking around the damaged area to protect an adjacent undamaged portion of the ceramic matrix composite coating not within the damaged area.~~

~~7~~4. The method of any one of claims 1 to ~~6~~3, 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~~5. The method of any one of claims 1 to ~~7~~4, further comprising applying a secondary coating to the ~~ceramic matrix composite~~ environmental barrier coating within the damaged area after heat treating the dried restoration slurry.

~~9~~6. The method of any one of claims 1 to ~~8~~5, further comprising finishing an outer surface of the ~~ceramic matrix composite~~ environmental barrier coating including the restored portion.

~~10~~7. The method of any one of claims 1 to ~~9~~6, 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 claims 1 to 10, further comprising leaving the in-service component as part of an assembly of which the in-service component is a part throughout method.~~

~~12~~8. The method of any one of claims 1 to ~~11~~7, 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 ~~ceramic matrix composite~~ environmental barrier coating.

~~13~~9. The method of any one of claims 1 to ~~12~~8, wherein the restoration slurry further comprises a pre-ceramic polymer.

~~14~~10. An assembly comprising:

a component including a substrate and an environmental barrier coating on the substrate, wherein the environmental barrier coating defines a damaged portion;

masking around the damaged portion on undamaged portions of the environmental barrier coating; and

a restoration slurry in the damaged portion, wherein the restoration slurry comprises a liquid carrier and a restoration coating material.

~~15~~11. The assembly of claim ~~14~~10, wherein the assembly comprises a gas turbine engine, and wherein the component comprises a turbine blade, a turbine vane, a blade track, or a combustion liner.

~~16~~12. The assembly of claim ~~14 or 15~~ 10 or 11, wherein restoration coating material comprises at least one of mullite, a rare earth silicate, a rare earth oxide, alumina, zirconium oxide, hafnium oxide, zirconium silicate, hafnium silicate, titanium oxide, tantalum oxide, carbon, boron oxide, a borosilicate, an alkali metal oxide, an alkali earth metal oxide, silicon, a silicon alloy, aluminum, boron, germanium, silica, barium strontium aluminosilicate, barium aluminosilicate, calcium aluminosilicate, magnesium aluminosilicate, or lithium aluminosilicate.

~~17~~13. The assembly of any one of claims ~~14 to 16~~ 10 to 12, wherein the restoration slurry further comprises a fugitive material comprising at least one of a polymer or graphite.

~~18~~14. The assembly of any one of claims ~~14 to 17~~ 10 to 13, wherein the restoration slurry further comprises a binder.

~~19~~15. The assembly of any one of claims ~~14 to 18~~ 10 to 14, wherein the restoration slurry further comprises pre-ceramic polymer.

~~20. The assembly of any of claims 14 to 19, wherein the coating comprises an environmental barrier coating.~~