WHAT IS CLAIMED IS:

1. A method comprising:

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

preparing an exposed surface of the environmental barrier coating;

after preparing the exposed surface of the environmental barrier coating, 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~~2. The method of claim 1~~2~~, wherein preparing the environmental barrier coating includes at least one of:

removing a damaged area of the 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.

43. The method of ~~any one of~~ claims 1 or~~to~~ 32, wherein applying the restoration slurry includes selectively applying the restoration slurry to the damaged area with respect to an area adjacent the damaged area.

54. The method of any one of claims 1 to 43, further comprising applying a secondary coating to the environmental barrier coating within the damaged area after heat treating the dried restoration slurry.

65. The method of any one of claims 1 to ~~5~~4, further comprising finishing an outer surface of the environmental barrier coating including the restored portion.

~~7. The method of any one of claims 1 to 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.~~

86. The method of any one of claims 1 to 57, 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.

97. The method of any one of claims 1 to 86, wherein the restoration slurry further comprises a pre-ceramic polymer.

~~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.~~

~~11. The assembly of claim 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.~~

~~12. The assembly of claim 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.~~

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

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

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