WHAT IS CLAIMED IS:

1. A method of furnace-less brazing of a substrate, comprising:

providing a substrate having a brazing region thereon;

disposing a braze precursor material containing an aluminum powder, a platinum group metal powder, and at least 18 atomic percentage of a nickel powder on the brazing region; and

initiating an exothermic reaction of the braze precursor material such that the exothermic reaction produces a brazed material that reaches a temperature above a liquidus temperature for the brazed material.

2. The method of claim 1, wherein the brazed material cools to form a solidified braze material comprising a nickel alloy having at least 5 vol.% gamma face-centered-cubic (FCC) nickel phase.

3. The method of claim 1, wherein the braze precursor material comprises an atomic ratio of palladium to nickel of from 0.43 to 2.33, wherein the braze precursor material comprises an atomic ratio of aluminum to a sum of palladium and nickel of from 0.15 to 0.67, further wherein the braze precursor material comprises less than or equal to 50 atomic% of nickel.

4. The method of claim 1, wherein the braze precursor material comprises an atomic ratio of palladium to nickel of from about 0.54 to 1.67, wherein the braze precursor material comprises an atomic ratio of aluminum to a sum of palladium and nickel of from 0.16 to 0.47, further wherein the braze precursor material comprises less than or equal to 50 atomic% nickel.

5. The method of claim 1, wherein the braze precursor material further comprises boron, cobalt, titanium, platinum, one or more metal oxides or combinations thereof.

6. The method of claim 1, wherein a ratio of a median particle size of the nickel powder to a median particle size of the aluminum powder is from 7:1 to 2:1.

7. The method of claim 1, wherein a ratio of a median particle size of the platinum-group metal powder to a median size of the aluminum powder is from 7:1 to 2:1.

8. The method of claim 1, wherein a median particle size of the aluminum powder is between 3 μm to 75 μm.

9. The method of claim 1, wherein a median particle size of the nickel powder is from 50 μm to 90 μm.

10. The method of claim 1, wherein the braze temperature is above a liquidus temperature of the brazed material.

11. The method of claim 1, wherein the braze temperature is capable of partially melting an adjacent surface of the metal substrate to enhance bonding between the brazed material and the substrate.

12. The method of claim 1, wherein the brazing region comprises a repair region comprising a pit, partial crack, or through-thickness crack in the substrate.

13. The method of claim 1, wherein the brazing region comprises a joint gap between two metallic substrates to be joined.

14. The method of claim 1, wherein the substrate is part of a component for a gas turbine engine.

15. The method of claim 1, comprising prior to initiating an exothermic reaction of the braze precursor material, disposing a heat source material on the braze precursor material on the brazing region.

16. The method of claim 1, wherein the braze temperature exceeds a melting temperature of an adjacent surface of the substrate to enhance bonding between the brazed material and the substrate.

17. The method of claim 15, further comprising a step of alloying the heat source material with the brazed material.

18. The method of claim 1, further comprising a step of pretreating the substrate to remove contaminants to facilitate wetting at least part of the brazed material to the substrate.

19. The method of claim 1, further comprising a step of alloying the brazed material with the substrate.

20. The method of claim 1, wherein the braze precursor material includes a melting point suppressant so that the braze precursor material melts at a temperature below a melting temperature of the substrate.