WHAT IS CLAIMED IS:

1. A method comprising:

positioning a first component comprising a first metal or alloy and a second component comprising a second metal or alloy to each other to define a joint region between adjacent portions of the first component and the second component;

positioning a pre-sintered preform (PSP) braze material in the joint region, wherein the PSP braze material comprises a wide gap braze material comprising between 50 wt. % and 90 wt. % Ni, up to 15 wt. % Cr, up to 10 wt. % Ta, up to 10 wt. % Co, up to 7 wt. % Al, between 2 wt. % and 4 wt. % W, up to 2 wt. % Re, up to 1 wt. % Mo, up to 1 wt. % Hf, up to 0.5 wt. % Nb, up to 3.0 wt. % Si, and up to 3 wt. % B;

heating the PSP braze material to form a molten braze alloy; and

cooling the molten braze alloy to join the first and second components.

2. The method of claim 1, wherein the PSP braze material comprises between 50 wt. % and 70 wt. % Ni, between 10 wt. % and 15 wt. % Cr, between 8 wt. % and 10 wt. % Ta, between 8 wt. % and 10 wt. % Co, between 4 wt. % and 7 wt. % Al, between 2 wt. % and 4 wt. % W, between 1 wt. % and 2 wt. % Re, between 0.5 wt. % and 1 wt. % Mo, between 0.5 wt. % and 1 wt. % Hf, between 0.1 wt. % and 0.5 wt. % Nb, between 0.05 wt. % and 3.0 wt. % Si, and between 0.5 wt. % and 2 wt. % B.

3. The method of claim 1, wherein the PSP braze material comprises 58 wt. % Ni, 11 wt. % Cr, 9 wt. % Ta, 9 wt. % Co, 5 wt. % Al, 3 wt. % W, 1 wt. % Mo, 1 wt. % Re, and 1 wt. % Hf.

4. The method of claim 1, wherein the PSP braze material comprises between 10.2 wt. % and 11.3 wt. % Cr, between 4.8 wt. % and 5.1 wt. % Al, between 9.1 wt. % and 9.8 wt. % Co, between 2.8 wt. % and 3.3 wt. % W, between 0.7 wt. % and 0.9 wt. % Mo, between 8.2 wt. % and 8.8 wt. % Ta, between 0.6 wt. % and 0.8 wt. % B, 0.3 wt. %

Si, between 1.5 wt. % and 1.8 wt. % Re, and between 0.8 wt. % and 0.9 wt. % Hf, and between 0.1 wt. % and 0.2 wt. % Nb.

5. The method of claim 1, wherein the PSP braze material further comprises between greater than 0 wt. % and 1 wt. % each of at least one of Ti, Nb, Pd, Pt, Ir, Ru, C, P, Mn, Fe, Ce, La, Y, or Zr.

6. The method of any one of claim 1, wherein the PSP braze material comprises a low-melt powder composition comprising between 50 wt. % and 70 wt. % Ni, between 8 wt. % and 20 wt. % Cr, between 8 wt. % and 15 wt. % Ta, between 4 wt. % and 10 wt. % Co, between 2 wt. % and 7 wt. % Al, and up to 2.25 wt. % B and a high-melt powder composition comprising between 50 wt. % and 70 wt. % Ni, between 2 wt. % and 10 wt. % Cr, between 2 wt. % and 10 wt. % Ta, between 5 wt. % and 15 wt. % Co, between 2 wt. % and 10 wt. % Al, between 2 wt. % and 10 wt. % W, up to 3 wt. % Re, up to 3 wt. % Mo, and up to 3 wt. % Hf.

7. The method of claim 6, wherein the low-melt powder composition further comprises between greater than 0 wt. % and 1 wt. % each of at least one of Ti, W, Mo, Re, Nb, Hf, Pd, Pt, Ir, Ru, C, Si, P, Mn, Fe, Ce, La, Y or Zr.

8. The method of any one of claims 1 to 7, wherein the first metal or alloy comprises a Ni-based or a Co-based superalloy, and wherein the second metal or alloy comprises a Ni-based or a Co-based superalloy.

9. The method of any one of claims 1 to 8, wherein heating the PSP braze material to form the molten braze alloy comprises heating the first component, the second component, and the PSP braze material in a vacuum furnace.

10. The method of claim 9, wherein heating the first component, the second component, and the PSP braze material in a vacuum furnace comprises heating the first

component, the second component, and the PSP braze material at a temperature between 1093°C and 1260°C in a vacuum furnace.

11. The method of any one of claims 1 to 10, further comprising, after cooling the molten braze alloy to join the first and second components, heat treating the first and second components using a stepped diffusion cycle by at least heating the first and second components to 1038°C for 1 hour to 2 hours; heating the first and second components to 1093° for 1 hour to 2 hours; heating the first and second components to 1121°C for 1 hour to 2 hours; heating the first and second components to 1149°C for 1 hour to 18 hours; and cooling the first and second components to room temperature.

12. An assembly comprising:

a first component comprising a first metal or alloy;

a second component comprising a second metal or alloy, wherein the first component and second component are positioned adjacent to each other to define a joint region between adjacent portions of the first component and the second component;

a pre-sintered preform (PSP) braze material disposed in the joint region, wherein the PSP braze material comprises a wide gap braze material comprising between 50 wt. % and 90 wt. % Ni, up to 15 wt. % Cr, up to 10 wt. % Ta, up to 10 wt. % Co, up to 7 wt. % Al, up to 4 wt. % W, up to 2 wt. % Re, up to 1 wt. % Mo, up to 1 wt. % Hf, up to 0.5 wt. % Nb, up to 3.0 wt. % Si, and up to 3 wt. % B; and

a heat source configured to heat the PSP braze material when the PSP braze material is disposed in the joint region.

13. The assembly of claim 12, wherein the PSP braze material comprises between 50 wt. % and 70 wt. % Ni, between 10 wt. % and 15 wt. % Cr, between 8 wt. % and 10 wt. % Ta, between 8 wt. % and 10 wt. % Co, between 4 wt. % and 7 wt. % Al, between 2 wt. % and 4 wt. % W, between 1 wt. % and 2 wt. % Re, between 0.5 wt. % and 1 wt. % Mo, and between 0.5 wt. % and 1 wt. % Hf, between 0.1 wt. % and 0.5 wt. % Nb, between 0.05 wt. % and 3.0 wt. % Si, and between 0.5 wt. % and 2 wt. % B.

14. The assembly of claim 12, wherein the PSP braze material comprises 58 wt. % Ni, 11 wt. % Cr, 9 wt. % Ta, 9 wt. % Co, 5 wt. % Al, 3 wt. % W, 1 wt. % Mo, 1 wt. % Re, and 1 wt. % Hf.

15. The assembly of claim 12, wherein the PSP braze material comprises between 10.2 wt. % and 11.3 wt. % Cr, between 4.8 wt. % and 5.1 wt. % Al, between 9.1 wt. % and 9.8 wt. % Co, between 2.8 wt. % and 3.3 wt. % W, between 0.7 wt. % and 0.9 wt. % Mo, between 8.2 wt. % and 8.8 wt. % Ta, between 0.6 wt. % and 0.8 wt. % B, 0.3 wt. % Si, between 1.5 wt. % and 1.8 wt. % Re, and between 0.8 wt. % and 0.9 wt. % Hf, and 0.1 wt. % and 0.2 wt. % Nb.

16. The assembly of claim 12, wherein the PSP braze material further comprises between greater than 0 wt. % and 1 wt. % each of at least one of Ti, Nb, Pd, Pt, Ir, Ru, C, P, Mn, Fe, Ce, La, Y, or Zr.

17. The assembly of claim 12, wherein the PSP braze material comprises a low-melt powder composition comprising between 50 wt. % and 70 wt. % Ni, between 8 wt. % and 20 wt. % Cr, between 8 wt. % and 15 wt. % Ta, between 4 wt. % and 10 wt. % Co, between 2 wt. % and 7 wt. % Al, and up to 2.25 wt. % B and a high-melt powder composition comprising between 50 wt. % and 70 wt. % Ni, between 2 wt. % and 10 wt. % Cr, between 2 wt. % and 10 wt. % Ta, between 5 wt. % and 15 wt. % Co, between 2 wt. % and 10 wt. % Al, between 2 wt. % and 10 wt. % W, up to 3 wt. % Re, up to 3 wt. % Mo, and up to 3 wt. % Hf.

18. The assembly of claim 17, wherein the low-melt powder composition further comprises between greater than 0 wt. % and 1 wt. % each of at least one of Ti, W, Mo, Re, Nb, Hf, Pd, Pt, Ir, Ru, C, Si, P, Mn, Fe, Ce, La, Y, or Zr.

19. The assembly of claim 17 or 18, wherein the first metal or alloy comprises a Ni-based or a Co-based superalloy, and wherein the second metal or alloy comprises a Ni-based or a Co-based superalloy.

20. The assembly of any one of claims 12 to 19, wherein the heat source comprises a vacuum furnace.