

CLAIMS

What is claimed is:

1. A carbon black air preheater, wherein at least a portion of the carbon black air preheater comprises an alloy comprising from about 3 wt.% to about 10 wt.% aluminum, from about 18 wt.% to about 28 wt.% chromium, from about 0 wt.% to about 0.1 wt.% carbon, from about 0 wt.% to about 3 wt.% silicon, from about 0 wt.% to about 0.4 wt.% manganese, from about 0 wt.% to about 0.5 wt.% molybdenum, and a remaining balance of iron.
2. The carbon black air preheater of claim 1, wherein the alloy further comprises from about 0 wt.% to about 37 wt.% nickel, from about 0 wt.% to about 29 wt.% cobalt.
3. The carbon black air preheater of claim 1, wherein the alloy comprises from about 5 wt.% to about 6 wt.% aluminum, from about 20 wt.% to about 21 wt.% chromium, from about 0 wt.% to about 0.08 wt.% carbon, from about 0.1 wt.% to about 0.7 wt.% silicon, from about 0 wt.% to about 0.4 wt.% manganese, from about 0 wt.% to about 3 wt.% molybdenum, from about 0 wt.% to about 1 wt.% nickel, from about 0 wt.% to about 1 wt.% cobalt, and a remaining balance of iron.
4. The carbon black air preheater of claim 1, wherein the alloy comprises from about 5 wt.% to about 6 wt.% aluminum, from about 20.5 wt.% to about 23.5 wt.% chromium, less than about 0.08 wt.% carbon, less than about 0.7 wt.% silicon, less than about 0.4 wt.% manganese, about 3 wt.% molybdenum, and a remaining balance of iron.
5. The carbon black air preheater of claim 1, wherein the alloy forms a surface passivating layer on at least a portion of the alloy upon sustained exposure to a carbon black manufacturing environment.
6. The carbon black air preheater of claim 1, wherein the alloy forms a surface alumina layer on at least a portion of the alloy upon exposure to a carbon black manufacturing environment.
7. The carbon black air preheater of claim 1, wherein the alloy further comprises a plurality of ceramic particles dispersed within the alloy.
8. The carbon black air preheater of claim 1, wherein the carbon black air preheater

- is a counter flow energy recovery heat exchanger.
9. The carbon black air preheater of claim 1, wherein the at least a portion of the carbon black air preheater comprises all or a portion of a plurality of tubes disposed within the carbon black air preheater.
 10. The carbon black air preheater of claim 1, wherein the at least a portion of the carbon black air preheater comprises a portion of one or more tubes disposed within the carbon black air preheater, wherein the portion of one or more tubes is located at a first end of the one or more tubes in fluid communication with a carbon black furnace.
 11. The carbon black air preheater of claim 1, wherein the carbon black air preheater is a part of a carbon black manufacturing process.
 12. The carbon black air preheater of claim 11, wherein the carbon black air preheater is in fluid communication with a carbon black furnace.
 13. The carbon black air preheater of claim 1, being capable of heating air to a temperature of at least about 1,000 °C for a sustained period of time.
 14. The carbon black air preheater of claim 1, being capable of heating air to a temperature of at least about 1,000 °C for a sustained period of time without significant degradation.
 15. The carbon black air preheater of claim 1, being capable of heating air to a temperature of from about 1,000 °C to about 1,300 °C.
 16. A carbon black manufacturing process comprising a carbon black furnace and a carbon black air preheater positioned downstream of and in fluid communication with the carbon black furnace, wherein the carbon black air preheater comprises an alloy comprising from about 3 wt.% to about 10 wt.% aluminum, from about 18 wt.% to about 28 wt.% chromium, from about 0 wt.% to about 0.1 wt.% carbon, from about 0 wt.% to about 3 wt.% silicon, from about 0 wt.% to about 0.4 wt.% manganese, from about 0 wt.% to about 0.5 wt.% molybdenum, and a remaining balance of iron.
 17. The carbon black manufacturing process of claim 16, wherein the alloy further comprises from about 0 wt.% to about 37 wt.% nickel, from about 0 wt.% to about 29 wt.% cobalt.
 18. The carbon black manufacturing process of claim 16, wherein the carbon black air preheater comprises an alloy comprising from about 5 wt.% to about 6 wt.% aluminum, from about 20 wt.% to about 21 wt.% chromium, from about 0 wt.% to

about 0.08 wt.% carbon, from about 0.1 wt.% to about 0.7 wt.% silicon, from about 0 wt.% to about 0.4 wt.% manganese, from about 0 wt.% to about 3 wt.% molybdenum, from about 0 wt.% to about 37 wt.% nickel, from about 0 wt.% to about 29 wt.% cobalt, and a remaining balance of iron.

19. The carbon black manufacturing process of claim 16, wherein the alloy forms a surface passivating layer on at least a portion of the alloy upon sustained exposure to a carbon black manufacturing environment.
20. The carbon black manufacturing process of claim 16, wherein the alloy forms an alumina layer on at least a portion of the alloy upon exposure to a carbon black manufacturing environment.
21. The carbon black manufacturing process of claim 16, wherein the alloy further comprises a plurality of ceramic particles dispersed within the alloy.