Claims

1. A method for fabricating a nitrogenous steel material, the method comprising:

preparing a material powder in a powder reservoir of an additive manufacturing apparatus, the material powder comprising:

a metal powder comprising iron; and

an alloying powder comprising nitrogen;

performing an additive manufacturing process under atmospheric pressure, the additive manufacturing process comprising:

displacing layers of the material powder from the powder reservoir to a build platform of the additive manufacturing apparatus; and

fusing the layers of material powder on the build platform to fabricate the nitrogenous steel material; and

controlling processing parameters of the additive manufacturing process such that the nitrogenous steel material fabricated from the additive manufacturing process is non-porous.

2. The method according to claim 1, wherein the metal powder comprises a substantially pure iron material and/or one or more ferroalloy materials.

3. The method according to claim 2, wherein the ferroalloy materials comprise ferromanganese and ferrochromium.

4. The method according to any one of claims 1 to 3, wherein the alloying powder comprises one or more of iron nitride, chromium nitride, ferrochrome nitride, manganese nitride, ferromanganese nitride, silicon nitride, and ferrosilicon nitride.

5. The method according to any one of claims 1 to 4, wherein the material powder further comprises a second alloying powder for improving corrosion resistance of the nitrogenous steel material.

6. The method according to claim 5, wherein the second alloying powder comprises one or more of molybdenum and titanium.

7. The method according to any one of claims 1 to 6, wherein the nitrogenous steel material comprises at least 0.4% nitrogen by weight.

8. The method according to claim 7, wherein the nitrogenous steel material comprises 0.4% to 2.0% nitrogen by weight.

9. The method according to any one of claims 1 to 8, further comprising:

mixing the metal powder with the alloying powder in a roller mill to form the material powder; and

transferring the material powder from the roller mill to the powder reservoir.

10. The method according to any one of claims 1 to 9, wherein the additive manufacturing process comprises selective laser melting.