CLAIMS

What is claimed is:

1. A method of fabricating polycrystalline diamond, comprising:

functionalizing surfaces of carbon-free nanoparticles with one or more functional groups;

combining the functionalized nanoparticles with diamond nanoparticles and diamond grit to form a particle mixture; and

subjecting the particle mixture to high pressure and high temperature (HPHT) conditions to form inter-granular bonds between the diamond nanoparticles and the diamond grit.

2. The method of claim 1, wherein functionalizing the surfaces of the carbon-free nanoparticles with one or more functional groups comprises functionalizing the surfaces of the carbon-free nanoparticles with methyl functional groups.

3. The method of claim 1, wherein functionalizing the surfaces of the carbon-free nanoparticles with one or more functional groups comprises functionalizing the surfaces of the carbon-free nanoparticles with acetylene functional groups.

4. The method of claim 1, further comprising selecting the carbon-free nanoparticles to comprise a metal or a metal alloy.

5. The method of claim 4, further comprising selecting the carbon-free nanoparticles to comprise one or more of iron, cobalt, and nickel.

6. The method of claim 1, further comprising selecting the carbon-free nanoparticles to comprise a ceramic material.

7. The method of claim 6, further comprising selecting the carbon-free nanoparticles to comprise one or more of an oxide and a nitride.

8. The method of claim 6, further comprising selecting the carbon-free nanoparticles to comprise alumina or magnesia.

9. The method of claim 1, wherein combining the functionalized nanoparticles with the diamond nanoparticles and the diamond grit to form the particle mixture comprises:

suspending the functionalized nanoparticles and the diamond nanoparticles in a liquid to form a suspension; and

drying the suspension.

10. The method of claim 9, wherein drying the suspension comprises one or more of spray drying, freeze drying, and flash drying the suspension.

11. The method of claim 9, further comprising suspending the diamond grit in the liquid.

12. The method of claim 9, wherein drying the suspension comprises drying the suspension to form a powder product.

13. The method of claim 12, further comprising mixing the powder product with the diamond grit to form the particle mixture.

14. The method of claim 13, further comprising milling the particle mixture prior to subjecting the particle mixture to the HPHT conditions.

15. The method of claim 12, further comprising milling the powder product.

16. The method of claim 1, wherein subjecting the particle mixture to the HPHT conditions comprises subjecting the particle mixture to a temperature of at least about 1400°C and a pressure of at least about 5.0 GPa.

17. A cutting element for use in an earth-boring tool, the cutting element comprising a polycrystalline diamond material formed by a method comprising:

functionalizing surfaces of carbon-free nanoparticles with one or more functional groups;

combining the functionalized nanoparticles with diamond nanoparticles and diamond grit to form a particle mixture; and

subjecting the particle mixture to high pressure and high temperature (HPHT) conditions to form inter-granular bonds between the diamond nanoparticles and the diamond grit.

18. The cutting element of claim 17, wherein functionalizing the surfaces of the carbon-free nanoparticles with one or more functional groups comprises functionalizing the surfaces of the carbon-free nanoparticles with methyl or acetylene functional groups.

19. An earth-boring tool comprising a cutting element, the cutting element comprising a polycrystalline diamond material formed by a method comprising:

functionalizing surfaces of carbon-free nanoparticles with one or more functional groups;

combining the functionalized nanoparticles with diamond nanoparticles and diamond grit to form a particle mixture; and

subjecting the particle mixture to high pressure and high temperature (HPHT) conditions to form inter-granular bonds between the diamond nanoparticles and the diamond grit.

20. The earth-boring tool of claim 19, further comprising selecting the carbon-free nanoparticles to comprise a ceramic, a metal, or a metal alloy.

21. The earth-boring tool of claim 19, wherein the earth-boring tool comprises an earth-boring rotary drill bit.

CLAIMS

1. A method of fabricating polycrystalline diamond, comprising:

functionalizing surfaces of carbon-free nanoparticles comprising a ceramic material with one or more functional groups;

combining the functionalized nanoparticles with diamond nanoparticles and diamond grit to form a particle mixture; and

subjecting the particle mixture to high pressure and high temperature (HPHT) conditions to form inter-granular bonds between the diamond nanoparticles and the diamond grit.

2. The method of claim 1, wherein functionalizing the surfaces of the carbon-free nanoparticles with one or more functional groups comprises functionalizing the surfaces of the carbon-free nanoparticles with methyl functional groups.

3. The method of claim 1, wherein functionalizing the surfaces of the carbon-free nanoparticles with one or more functional groups comprises functionalizing the surfaces of the carbon-free nanoparticles with acetylene functional groups.

4. The method of claim 1, further comprising selecting the carbon-free nanoparticles to comprise one or more of an oxide and a nitride.

5. The method of claim 1, further comprising selecting the carbon-free nanoparticles to comprise alumina or magnesia.

6. The method of claim 1, wherein combining the functionalized nanoparticles with the diamond nanoparticles and the diamond grit to form the particle mixture comprises:

suspending the functionalized nanoparticles and the diamond nanoparticles in a liquid to form a suspension; and

drying the suspension.

7. The method of claim 6, wherein drying the suspension comprises one or more of spray drying, freeze drying, and flash drying the suspension.

8. The method of claim 6, further comprising suspending the diamond grit in the liquid.

9. The method of claim 6, wherein drying the suspension comprises drying the suspension to form a powder product.

10. A method of fabricating polycrystalline diamond, comprising:
functionalizing surfaces of carbon-free nanoparticles with one or more functional groups;
combining the functionalized nanoparticles with diamond nanoparticles and diamond grit to form a particle mixture, the combining comprising:
suspending the functionalized nanoparticles and the diamond nanoparticles in a liquid to form a suspension;
drying the suspension to form a powder product; and
mixing the powder product with the diamond grit to form the particle mixture; and
subjecting the particle mixture to high pressure and high temperature (HPHT) conditions to form inter-granular bonds between the diamond nanoparticles and the diamond grit.

11. The method of claim 10, further comprising milling the particle mixture prior to subjecting the particle mixture to the HPHT conditions.

12. The method of claim 9, further comprising milling the powder product.

13. The method of claim 1, wherein subjecting the particle mixture to the HPHT conditions comprises subjecting the particle mixture to a temperature of at least about 1400°C and a pressure of at least about 5.0 GPa.

14. A cutting element for use in an earth-boring tool, the cutting element comprising a polycrystalline diamond material formed by a method comprising:
functionalizing surfaces of carbon-free nanoparticles comprising a ceramic material with one or more functional groups;
combining the functionalized nanoparticles with diamond nanoparticles and diamond grit to form a particle mixture; and

subjecting the particle mixture to high pressure and high temperature (HPHT) conditions to form inter-granular bonds between the diamond nanoparticles and the diamond grit.

15. The cutting element of claim 14, wherein functionalizing the surfaces of the carbon-free nanoparticles with one or more functional groups comprises functionalizing the surfaces of the carbon-free nanoparticles with methyl or acetylene functional groups.

16. An earth-boring tool comprising a cutting element, the cutting element comprising a polycrystalline diamond material formed by a method comprising:

functionalizing surfaces of carbon-free nanoparticles comprising a ceramic material with one or more functional groups;

combining the functionalized nanoparticles with diamond nanoparticles and diamond grit to form a particle mixture; and

subjecting the particle mixture to high pressure and high temperature (HPHT) conditions to form inter-granular bonds between the diamond nanoparticles and the diamond grit.

17. The earth-boring tool of claim 16, wherein the earth-boring tool comprises an earth-boring rotary drill bit.