CLAIMS

What is claimed is:

1. A method of forming a polycrystalline compact, the method comprising:

combining a plurality of hard particles with a metal salt to form a powder mixture; and

sintering the powder mixture.

2. The method of claim 1, wherein combining a plurality of hard particles with a metal salt comprises combining the plurality of hard particles and a metal salt comprising at least one of lithium fluoride, magnesium fluoride, calcium fluoride, yttrium fluoride, lanthanum fluoride and aluminum fluoride.

3. The method of claim 1, wherein combining a plurality of hard particles with a metal salt comprises combining the plurality of hard particles with a metal salt consisting of lithium fluoride.

4. The method of claim 1 or 2, wherein combining a plurality of hard particles with a metal salt comprises combining the plurality of hard particles with a metal salt dispersed in an organic solvent.

5. The method of claim 1 or 3, wherein combining a plurality of hard particles with a metal salt comprises dispersing the plurality of hard particles with particles of lithium fluoride in an organic solvent.

6. The method of claim 1 or 2, wherein combining a plurality of hard particles with a metal salt comprises combining a plurality of hard particles with a solution comprising the metal salt dissolved in a polar solvent.

7. The method of claim 1 or 2, wherein combining a plurality of hard particles with a metal salt comprises combining a plurality of hard particles comprising diamond with the metal salt.

8. The method of claim 1, wherein combining a plurality of hard particles with a metal salt to form a powder mixture comprises:

combining the plurality of hard particles with the metal salt in at least one solvent to form a slurry; and

subjecting the slurry to a spray-drying process to form the powder mixture.

9. The method of claim 1, wherein combining a plurality of hard particles with a metal salt to form a powder mixture comprises subjecting the plurality of hard particles and a plurality of particles of the metal salt to a milling process.

10. The method of claim 1, wherein sintering the powder mixture comprises fully sintering the powder mixture to form a hard polycrystalline material comprising interbonded hard particles of the plurality.

11. The method of claim 10, further comprising leaving at least a portion of the metal salt within interstitial spaces within the interbonded hard particles.

12. The method of claim 1, wherein sintering the powder mixture comprises removing at least a portion of the metal salt from interstitial spaces between the interbonded hard particles.

13. The method of claim 12, wherein removing at least a portion of the metal salt from interstitial spaces between the interbonded hard particles comprises reacting a constituent of the metal salt with at least one catalyst material in contact with the powder mixture.

14. The method of claim 1, wherein sintering the powder mixture comprises heating the powder mixture form a liquid of a constituent of the metal salt between hard particles of the plurality.

15. The method of claim 1, further comprising molding the powder mixture to form an unsintered preform.

16. The method of claim 16, wherein sintering the powder mixture comprises reacting silicon material with a constituent of the metal salt of the powder mixture.

17. A method of forming a polycrystalline compact, comprising:

forming an unsintered compact preform, comprising:

forming a powder mixture comprising a metal salt and a plurality of grains of hard material; and

disposing the powder mixture within a container;

disposing a cutting element substrate in contact with the powder mixture within the container; and

sintering the unsintered compact preform .

18. The method of claim 17, wherein forming a powder mixture comprising a metal salt and a plurality of grains of hard material comprises combining at least one metal fluoride with the plurality of grains of hard material.

19. The method of claim 17, wherein forming a powder mixture comprising a metal salt and a plurality of grains of hard material comprises mixing a plurality particles comprising lithium fluoride with the plurality of grains of hard material.

20. The method of claim 19, further comprising selecting the plurality of particles comprising the lithium fluoride to have a particle size of about 10% of a particle size of the plurality of grains of hard material.

21. The method of claim 17, wherein forming a powder mixture comprising a metal salt and a plurality of grains of hard material comprises forming the powder mixture comprising particles of the metal salt substantially homogeneously dispersed with the plurality of grains of hard material.

22. The method of claim 17, further comprising exposing the polycrystalline compact to a temperature sufficient to volatilize the metal salt under vacuum pressure to remove a residual portion of the metal salt from the polycrystalline compact.

23. The method of claim 17, wherein disposing the powder mixture within a container comprises disposing the powder mixture in contact with a silicon material proximate an inner surface of the container.

24. The method of claim 17, wherein sintering the unsintered compact perform comprises heating the unsintered compact preform to melt a metal constituent of the metal salt into a liquid that occupies interstitial spaces between the grains of hard material.

25. The method of claim 24, wherein heating the unsintered compact preform to melt the constituent of the metal salt into a liquid that occupies spaces between the grains of hard material comprises lubricating the spaces between the grains of hard material to promote rearrangement of the grains of hard material

26. A cutting element, comprising inter-bonded grains of diamond having a metal diffused thereinto.

27. The cutting element of claim 26, wherein the metal comprises lithium.

28. An earth-boring tool, comprising:

a body; and

at least one cutting element comprising inter-bonded diamond grains having a metal diffused thereinto.

29. The earth-boring tool of claim 28, wherein the metal comprises lithium.

CLAIMS

What is claimed is:

1. A method of forming a polycrystalline compact, the method comprising:

combining a plurality of diamond particles with lithium fluoride to form a powder mixture comprising the diamond particles and the lithium fluoride substantially homogeneously dispersed on the diamond particles; and

sintering the powder mixture comprising the diamond particles and the lithium fluoride, wherein combining a plurality of diamond particles with fluoride comprises combining the plurality of diamond particles with the lithium fluoride dispersed in an organic solvent.

2. The method of claim 1, wherein combining a plurality of diamond particles with lithium fluoride comprises dispersing the plurality of diamond particles with particles of the lithium fluoride in an organic solvent.

3. The method of claim 1, wherein combining a plurality of diamond particles with lithium fluoride comprises combining a plurality of diamond particles with a solution comprising the lithium fluoride dissolved in a polar solvent.

4. The method of claim 1, wherein combining a plurality of diamond particles with lithium fluoride to form a powder mixture comprises:

combining the plurality of diamond particles with the lithium fluoride in at least one solvent to form a slurry; and

subjecting the slurry to a spray-drying process to form the powder mixture.

5. The method of claim 1, wherein combining a plurality of diamond particles with lithium fluoride to form a powder mixture comprises subjecting the plurality of diamond particles and a plurality of particles of the lithium fluoride to a milling process.

6. The method of claim 1, wherein sintering the powder mixture comprising the diamond particles and the lithium fluoride comprises fully sintering the powder mixture

comprising the diamond particles and the lithium fluoride to form a hard polycrystalline material comprising interbonded hard particles of the plurality.

7. The method of claim 6, further comprising leaving at least a portion of the lithium fluoride within interstitial spaces between the interbonded hard particles.

8. The method of claim 1, wherein sintering the powder mixture comprising the diamond particles and the lithium fluoride comprises removing at least a portion of the lithium fluoride from interstitial spaces between the diamond particles.

9. The method of claim 8, wherein removing at least a portion of the lithium fluoride from interstitial spaces between the diamond particles comprises reacting fluorine of the lithium fluoride with at least one catalyst material in contact with the powder mixture.

10. The method of claim 1, wherein sintering the powder mixture comprising the diamond particles and the lithium fluoride comprises heating the powder mixture to form liquid lithium fluoride between diamond particles of the plurality.

11. The method of claim 1, further comprising molding the powder mixture comprising the diamond particles and the lithium fluoride to form an unsintered preform.

12. The method of claim 1, wherein sintering the powder mixture comprising the diamond particles and the lithium fluoride comprises reacting a silicon material with fluorine of the lithium fluoride.

13. A method of forming a polycrystalline compact, comprising:

forming an unsintered compact preform, comprising:

mixing a solution comprising lithium fluoride with a plurality of diamond grains to form a powder mixture comprising a plurality of coated diamond grains comprising a coating of the lithium fluoride; and

disposing the powder mixture within a container;

disposing a cutting element substrate in contact with the powder mixture; and

sintering the unsintered compact perform.

14. The method of claim 13, further comprising evaporating a solvent from the solution comprising the lithium fluoride.

15. The method of claim 13, further comprising exposing the polycrystalline compact to a temperature sufficient to volatilize the lithium fluoride under vacuum pressure to remove a residual portion of the lithium fluoride from the polycrystalline compact.

16. The method of claim 13, wherein disposing the powder mixture within a container comprises disposing the powder mixture in contact with a silicon material proximate an inner surface of the container.

17. The method of claim 13, wherein sintering the unsintered compact perform comprises heating the unsintered compact preform to melt the lithium fluoride to form a liquid that occupies interstitial spaces between the diamond grains.

18. The method of claim 17, wherein heating the unsintered compact preform to melt the lithium fluoride to form a liquid that occupies spaces between the grains of hard material comprises lubricating the spaces between the diamond grains to promote rearrangement of the diamond grains.