CLAIMS

What is claimed is:

1. A method of forming a polycrystalline table, comprising:

disposing a plurality of particles comprising a superabrasive material, a substrate comprising a hard material, and a catalyst material in a mold;

partially sintering the plurality of particles in the presence of the catalyst material to form a brown polycrystalline table having a first permeability attached to an end of the substrate;

removing the substrate from the brown polycrystalline table;

removing catalyst material from the brown polycrystalline table; and

fully sintering the brown polycrystalline table to form a polycrystalline table having a reduced, second permeability.

2. The method of claim 1, further comprising:

minimizing grain growth of the first plurality of particles comprising a superabrasive material during the partial sintering thereof.

3. The method of claim 1, wherein fully sintering the brown polycrystalline table to form a polycrystalline table comprises attaching the polycrystalline table to an end of another substrate.

4. The method of claim 1, wherein removing catalyst material from the brown polycrystalline table comprises removing at least substantially all the catalyst material from the brown polycrystalline table.

5. The method of any one of claims 1 through 4, further comprising:

distributing another plurality of particles comprising a non-catalyst material removable by a leaching agent among the first plurality of particles prior to sintering; and

removing the non-catalyst material removable by a leaching agent from the brown polycrystalline table substantially simultaneously with removal of the catalyst material.

6. The method of any one of claims 1 through 4, further comprising:
disposing the brown polycrystalline table on a fully sintered polycrystalline table attached to an end of a substrate before fully sintering the brown polycrystalline table.

7. The method of claim 6, further comprising:
exposing at least a portion of the substrate at a surface of the fully sintered polycrystalline table to which the brown polycrystalline table is to be attached.

8. The method of claim 6, further comprising:
selecting the fully sintered polycrystalline table to have a permeability exhibiting, for a thickness of 2 mm, a leach rate of greater than about five weeks to substantially completely remove catalyst material from the fully sintered polycrystalline table.

9. The method of any one of claims 1 through 4, wherein partially sintering the plurality of particles in the presence of the catalyst material to form a brown polycrystalline table having a first permeability attached to an end of the substrate comprises partially sintering the plurality of particles comprising a superabrasive material to form a brown polycrystalline table having greater than 10% by volume of another material disposed in interstitial spaces between interbonded grains of superabrasive material.

10. The method of claim 9, wherein partially sintering the plurality of particles in the presence of the catalyst material to form a brown polycrystalline table having a first permeability attached to an end of the substrate comprises partially sintering the plurality of particles to form a brown polycrystalline table having greater than 15% by volume of another material disposed in interstitial spaces between interbonded grains of superabrasive material.

11. The method of any one of claims 1 through 4, wherein partially sintering the plurality of particles in the presence of the catalyst material to form a brown polycrystalline table having a first permeability attached to an end of the substrate comprises partially sintering the plurality of particles to form a brown polycrystalline table exhibiting, for a thickness of about 2 mm, a leach rate of less than about two weeks to substantially completely remove catalyst material from the brown polycrystalline table.

12. The method of any one of claims 1 through 4, wherein partially sintering the plurality of particles in the presence of the catalyst material to form a brown polycrystalline table having a first permeability attached to an end of the substrate comprises pressing the first plurality of particles comprising a superabrasive material, the substrate, and the catalyst material with at least about 5 GPa of pressure at a temperature of at least about 1400 °C for less than about 5 min.

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

partially sintering a plurality of particles comprising a superabrasive material in the presence of a catalyst material and a substrate comprising a hard material to form a brown polycrystalline table attached to an end of the substrate;

removing the substrate;

leaching the catalyst material from the brown polycrystalline table;

disposing the brown polycrystalline table on another substrate; and

fully sintering the brown polycrystalline table in the presence of another different catalyst material and the another substrate to form a polycrystalline table attached to an end of the another substrate.

14. The method of claim 13, further comprising:

minimizing grain growth of the first plurality of particles comprising a superabrasive material during the partial sintering.

15. The method of claim 13, wherein leaching the catalyst material from the brown polycrystalline table comprises substantially fully leaching the catalyst material from the brown polycrystalline table.

16. The method of any one of claims 13 through 15, wherein partially sintering a plurality of particles comprising a superabrasive material in the presence of a catalyst material and a substrate comprising a hard material to form a brown polycrystalline table attached to an end of the substrate comprises forming a brown polycrystalline table having greater than 10% by volume of another material disposed in interstitial spaces between interbonded grains of superabrasive material.

17. The method of any one of claims 13 through 15, wherein partially sintering a plurality of particles comprising a superabrasive material in the presence of a catalyst material and a substrate comprising a hard material to form a brown polycrystalline table attached to an end of the substrate comprises forming a brown polycrystalline table exhibiting, for a thickness of about 2 mm, a leach rate of less than about two weeks to fully leach the brown polycrystalline table.

18. An intermediate structure formed during a process of attaching a polycrystalline table to a substrate, comprising:

a substantially fully leached brown polycrystalline table, the substantially fully leached brown polycrystalline table comprising a plurality of interbonded grains of a superabrasive material.

19. The intermediate structure of claim 18, wherein the substantially fully leached brown polycrystalline table exhibits sufficient strength to retain a shape thereof independent of external structural support.

20. The intermediate structure of claim 18 or claim 19, further comprising:

a substrate comprising a hard material and having an end to which the brown polycrystalline table is attached.

CLAIMS

What is claimed is:

1. A method of forming a polycrystalline table, comprising:

disposing a plurality of particles comprising a superabrasive material, a substrate comprising a hard material, and a catalyst material in a mold;

partially sintering the plurality of particles in the presence of the catalyst material to form a brown polycrystalline table having a first permeability attached to an end of the substrate;

removing the substrate from the brown polycrystalline table;

removing catalyst material from the brown polycrystalline table; and

fully sintering the brown polycrystalline table to form a polycrystalline table having a reduced, second permeability.

2. The method of claim 1, further comprising:

distributing another plurality of particles comprising a non-catalyst material removable by a leaching agent among the plurality of particles prior to sintering; and

removing the non-catalyst material removable by a leaching agent from the brown polycrystalline table substantially simultaneously with removal of the catalyst material.

3. The method of claim 1, further comprising:

minimizing grain growth of the plurality of particles comprising a superabrasive material during the partial sintering thereof.

4. The method of claim 1, wherein fully sintering the brown polycrystalline table to form a polycrystalline table comprises attaching the polycrystalline table to an end of another substrate.

5. The method of claim 1, wherein removing catalyst material from the brown polycrystalline table comprises removing at least substantially all the catalyst material from the brown polycrystalline table.

6. The method of claim 1, further comprising:

disposing the brown polycrystalline table on a fully sintered polycrystalline table attached to an end of a substrate before fully sintering the brown polycrystalline table.

7. The method of claim 6, further comprising:

exposing at least a portion of the substrate at a surface of the fully sintered polycrystalline table to which the brown polycrystalline table is to be attached.

8. The method of claim 6, further comprising:

selecting the fully sintered polycrystalline table to have a permeability exhibiting, for a thickness of 2 mm, a leach rate of greater than about five weeks to substantially completely remove catalyst material from the fully sintered polycrystalline table.

9. The method of claim 1, wherein partially sintering the plurality of particles in the presence of the catalyst material to form a brown polycrystalline table having a first permeability attached to an end of the substrate comprises partially sintering the plurality of particles comprising a superabrasive material to form a brown polycrystalline table having greater than 10% by volume of another material disposed in interstitial spaces between interbonded grains of superabrasive material.

10. The method of claim 9, wherein partially sintering the plurality of particles in the presence of the catalyst material to form a brown polycrystalline table having a first permeability attached to an end of the substrate comprises partially sintering the plurality of particles to form a brown polycrystalline table having greater than 15% by volume of another material disposed in interstitial spaces between interbonded grains of superabrasive material.

11. The method of claim 1, wherein partially sintering the plurality of particles in the presence of the catalyst material to form a brown polycrystalline table having a first permeability attached to an end of the substrate comprises partially sintering the plurality of particles to form a brown polycrystalline table exhibiting, for a thickness of about 2 mm, a leach rate of less than about two weeks to substantially completely remove catalyst material from the brown polycrystalline table.

12. The method of claim 1, wherein partially sintering the plurality of particles in the presence of the catalyst material to form a brown polycrystalline table having a first permeability attached to an end of the substrate comprises pressing the first plurality of particles comprising a superabrasive material, the substrate, and the catalyst material with at least about 5 GPa of pressure at a temperature of at least about 1400 °C for less than about 5 minutes.

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

partially sintering a plurality of particles comprising a superabrasive material in the presence of a catalyst material and a substrate comprising a hard material to form a brown polycrystalline table attached to an end of the substrate;

removing the substrate;

leaching the catalyst material from the brown polycrystalline table;

disposing the brown polycrystalline table on another substrate; and

fully sintering the brown polycrystalline table in the presence of another different catalyst material and the another substrate to form a polycrystalline table attached to an end of the another substrate.

14. The method of claim 13, further comprising:

minimizing grain growth of the plurality of particles comprising a superabrasive material during the partial sintering.

15. The method of claim 13, wherein leaching the catalyst material from the brown polycrystalline table comprises substantially fully leaching the catalyst material from the brown polycrystalline table.

16. The method of claim 13, wherein partially sintering a plurality of particles comprising a superabrasive material in the presence of a catalyst material and a substrate comprising a hard material to form a brown polycrystalline table attached to an end of the substrate comprises forming a brown polycrystalline table having greater than 10% by volume of another material disposed in interstitial spaces between interbonded grains of superabrasive material.

17. The method of claim 13, wherein partially sintering a plurality of particles comprising a superabrasive material in the presence of a catalyst material and a substrate comprising a hard material to form a brown polycrystalline table attached to an end of the substrate comprises forming a brown polycrystalline table exhibiting, for a thickness of about 2 mm, a leach rate of less than about two weeks to fully leach the brown polycrystalline table.