CLAIMS

What is claimed is:

1. A cutting element, comprising:

a supporting substrate; and

a polycrystalline compact attached to an upper surface of the supporting substrate and comprising:

a first region abutting the upper surface of the supporting substrate and comprising:

first interbonded larger grains comprising a first hard material;

first interbonded smaller grains comprising a first non-hard material; and

first interstitial spaces between the first interbonded larger grains and the first interbonded smaller grains and substantially filled with a catalyst material;

a second region abutting each of lateral boundaries of the first region and the upper surface of the supporting substrate and defining a lower portion of an outermost side surface of the polycrystalline compact, the second region including an inner portion extending radially along the lateral boundaries of the first region and an outer portion extending radially between the inner portion and the outermost side surface of the polycrystalline compact, the second region having a smaller average grain size than the first region and comprising:

second interbonded larger grains comprising a second hard material;

second interbonded smaller grains comprising a second non-hard material; and

second interstitial spaces between the second interbonded larger grains and the second interbonded smaller grains, the second interstitial spaces of the outer portion of the second region being substantially filled with an inert solid filler material, and only the outer portion of the second region being substantially free of the catalyst material; and

a third region abutting upper longitudinal boundaries of the first region and the second region and defining each of a cutting face of the polycrystalline compact and an upper portion of the outermost side surface of the polycrystalline compact, the third region having a different average grain size than the second region.

2. The cutting element of claim 1, wherein the first region comprises a first volume percentage of interconnected grains of material, and wherein the second region comprises a second, greater volume percentage of interconnected grains of material.

3. The cutting element of claim 1, wherein the first interstitial spaces of the first region have a first interconnectivity, and wherein the second interstitial spaces of the second region have a second, lesser interconnectivity.

4. The cutting element of claim 1, wherein the first region comprises a first volume percentage of the first interstitial spaces thereof, and wherein the second region comprises a second, smaller volume percentage of the second interstitial spaces thereof.

5. The cutting element of claim 1, wherein:

the second region abuts and completely covers entireties of the lateral boundaries of the first region; and

the third region abuts and completely covers entireties of the upper longitudinal boundaries of the first region and the second region.

6. The cutting element of claim 1, wherein the second region longitudinally extends from the upper surface of the supporting substrate to a lower longitudinal boundary of the third region.

7. The cutting element of claim 1, wherein the second region completely encloses lateral boundaries of the first region from the upper surface of the supporting substrate to a lower longitudinal boundary of the third region.

8. The cutting element of claim 1, wherein the first region extends from the upper surface of the supporting substrate to a lower longitudinal boundary of the third region.

9. A method of forming a cutting element, comprising:

providing a first plurality of particles comprising a first hard material into a container;

providing a second plurality of particles into the container on the first plurality of particles;

providing a third plurality of particles into the container on the first plurality of particles and adjacent lateral boundaries of the second plurality of particles, the third plurality of particles having an average grain size different than that of the first plurality of particles and smaller than that of the second plurality of particles;

providing a supporting substrate into the container on the second plurality of particles and the third plurality of particles; and

sintering the first plurality of particles, the second plurality of particles, and the third plurality of particles in the presence of a catalyst material to form a polycrystalline compact comprising:

a first region abutting the upper surface of the supporting substrate and comprising:

first interbonded larger grains comprising a first hard material;

first interbonded smaller grains comprising a first non-hard material; and

first interstitial spaces between the first interbonded larger grains and the first interbonded smaller grains and substantially filled with a catalyst material;

a second region abutting each of lateral boundaries of the first region and the upper surface of the supporting substrate and defining a lower portion of an outermost side surface of the polycrystalline compact, the second region including an inner portion extending radially along the lateral boundaries of the first region and an outer portion extending radially between the inner portion and the outermost side surface of the polycrystalline compact, the second region having a smaller average grain size than the first region and comprising:

second interbonded larger grains comprising a second hard material;

second interbonded smaller grains comprising a second non-hard material; and

second interstitial spaces between the second interbonded larger grains and the second interbonded smaller grains, the second interstitial spaces of the outer portion of the second region being substantially filled with an inert solid filler material, and only the outer portion of the second region being substantially free of the catalyst material; and

a third region abutting upper longitudinal boundaries of the first region and the second region and defining each of a cutting face of the polycrystalline compact and an upper portion of the outermost side surface of the polycrystalline compact, the third region having a different average grain size than the second region.

10. The method of claim 9,wherein providing the second plurality of particles into the container comprises forming the second plurality of particles into a desired shape of the first region.

11. The method of claim 10, wherein forming the second plurality of particles into a desired shape of the first region comprises pressing the second plurality of particles in the presence of a binder material to form a green structure of the desired shape prior to providing the third plurality of particles into the container.

12. The method claim 9, wherein providing the second plurality of particles into the container comprises providing the second plurality of particles into the container in a preform shape configured to be surrounded by the first plurality of particles and the third plurality of particles.

13. An earth-boring tool comprising at least one cutting element comprising:

a supporting substrate; and

a polycrystalline compact attached to an upper surface of the supporting substrate and comprising:

a first region abutting the upper surface of the supporting substrate and comprising:

first interbonded larger grains comprising a first hard material;

first interbonded smaller grains comprising a first non-hard material; and

first interstitial spaces between the first interbonded larger grains and the first interbonded smaller grains and substantially filled with a catalyst material;

a second region abutting each of lateral boundaries of the first region and the upper surface of the supporting substrate and defining a lower portion of an outermost side surface of the polycrystalline compact, the second region including an inner portion extending radially between the inner portion and the outermost side surface of the polycrystalline compact, the second region having a smaller average grain size than the first region and comprising:

second interbonded larger grains comprising a second hard material;

second interbonded smaller grains comprising a second non-hard material; and

second interstitial spaces between the second interbonded larger grains and the second interbonded smaller grains, the second interstitial spaces of the outer portion of the second region being substantially filled with an inert solid filler material, and only the outer portion of the second region being substantially free of the catalyst material; and

a third region abutting upper longitudinal boundaries of the first region and the second region and defining each of a cutting face of the polycrystalline compact and an upper portion of the outermost side surface of the polycrystalline compact, the third region having a different average grain size than the second region.

14. The earth-boring tool of claim 13, wherein the earth-boring tool comprises an earth-boring rotary drill bit.

15. The cutting element of claim 1, wherein the second region of the polycrystalline compact comprises from about 0.1 percent by weight to about 10 percent by weight of the second interbonded smaller grains.

16. The cutting element of claim 1, wherein:

an average grain size of the first interbonded larger grains of the first region is greater than an average grain size of the second interbonded larger grains of the second region; and

an average grain size of the first interbonded smaller grains of the first region is greater than an average grain size of the second interbonded smaller grains of the second region.

17. The cutting element of claim 1, wherein a material composition of the first non-hard material of the first interbonded smaller grains of the first region is different than that of the second non-hard material of the second interbonded smaller grains of the second region.