What is claimed is:

1. A process for producing a gradient nanovoided coating, comprising:

coating a first solution comprising a polymerizable material in a solvent onto a substrate;

providing a first environment proximate a first region of the coating and a different second environment proximate an adjacent region of the coating;

at least partially polymerizing the polymerizable material to form an insoluble polymer matrix bicontinuous with a plurality of nanovoids and a second solution, the plurality of nanovoids being filled with the second solution,

wherein a first volume fraction of the plurality of nanovoids proximate the first region of the coating is less than a second volume fraction of the plurality of nanovoids proximate the adjacent region of the coating; and

removing a major portion of the solvent from the second solution.

2. The process of claim 1, wherein the first environment comprises a polymerization inhibitor.

3. The process of claim 1, wherein an oxygen concentration proximate the first region that is greater than the oxygen concentration proximate the second region.

4. The process of claim 1, wherein a polymerization initiator concentration in the first region is less than the polymerization initiator concentration in the adjacent region.

5. The process of claim 1, further comprising an actinic radiation absorbing material in the first solution.

6. The process of claim 1, wherein removing a major portion of the solvent comprises drying in a thermal oven, drying with infrared or other radiant light sources, vacuum drying, gap drying, or a combination thereof.

7. A process for producing a gradient low refractive index coating, comprising:

coating a photoinitiator on a surface of a substrate;

coating a dispersion on the photoinitiator, the dispersion comprising:

an ultraviolet (UV) radiation curable material;

a solvent; and

a plurality of nanoparticles;

irradiating the dispersion with UV radiation to at least partially polymerize the UV radiation curable material, forming an insoluble polymer matrix binding the plurality of nanoparticles, and including a plurality of nanovoids, the plurality of nanovoids being filled with the dispersion depleted of the polymerizable material and the nanoparticles,

wherein a first volume fraction of the plurality of nanovoids proximate the surface of the substrate is greater than a second volume fraction of the plurality of nanovoids proximate an opposing surface of the insoluble polymer matrix; and

removing a major portion of the solvent from the dispersion after at least partially polymerizing the polymerizable material.

8. A process for producing a gradient low refractive index coating, comprising:

coating a dispersion on a surface of a substrate, the dispersion comprising:

an ultraviolet (UV) radiation curable material;

a photoinitiator;

a solvent; and

a plurality of nanoparticles;

providing at least a 100 part per million (ppm) oxygen atmosphere adjacent the dispersion;

irradiating the dispersion with UV radiation to at least partially polymerize the UV radiation curable material, forming an insoluble polymer matrix binding the plurality of nanoparticles, and including a plurality of

nanovoids, the plurality of nanovoids being filled with the dispersion depleted of the polymerizable material and the nanoparticles,

wherein a first volume fraction of the plurality of nanovoids proximate the surface of the substrate is greater than a second volume fraction of the plurality of nanovoids proximate an opposing surface of the insoluble polymer matrix; and

removing a major portion of the solvent from the dispersion after at least partially polymerizing the polymerizable material.

9. The process of claim 8, wherein the solvent comprises a blend of at least two organic solvents.

10. The process of claim 8, wherein removing a major portion of the solvent comprises drying in a thermal oven, drying with infrared or other radiant light sources, vacuum drying, gap drying, or a combination thereof.

11. A process for producing a gradient nanovoided coating, comprising:

coating a first solution comprising a polymerizable material in a solvent onto a substrate;

at least partially polymerizing the polymerizable material to form an insoluble polymer matrix bicontinuous with a plurality of nanovoids and a second solution, the plurality of nanovoids being filled with the second solution;

removing a major portion of the solvent from the second solution to form a nanovoided coating having a free surface;

coating a third solution on the free surface to at least partially fill the nanovoided coating; and

solidifying the third solution,

wherein a first volume fraction of the plurality of nanovoids proximate the free surface of the coating is less than a second volume fraction of the plurality of nanovoids proximate an opposing surface of the coating.

12. The process of claim 11, wherein the third solution comprises a second solvent, and solidifying includes removing the second solvent.

13. The process of claim 11, wherein the third solution comprises a curable material, and solidifying includes curing the curable material.

14. A process for producing a gradient nanovoided coating, comprising:

coating a first solution comprising a polymerizable material in a solvent onto a substrate;

at least partially polymerizing the polymerizable material to form a first layer including an insoluble polymer matrix bicontinuous with a plurality of nanovoids and a second solution, the plurality of nanovoids being filled with the second solution;

coating a third solution on the first layer to form a second layer;

solidifying the third solution; and

removing a major portion of the solvent from the second and the third solution to form a gradient nanovoided coating,

wherein a first volume fraction of the plurality of nanovoids within the first layer is different than a second volume fraction of the plurality of nanovoids within the second layer.

15. The process of claim 14, wherein the third solution comprises a third solvent, and solidifying includes removing the third solvent.

What is claimed is:

1. A process for producing a gradient nanovoided coating, comprising:

coating a first solution comprising a polymerizable material in a solvent onto a substrate;

providing a first environment proximate a first region of the coating and a different second environment proximate an adjacent region of the coating;

at least partially polymerizing the polymerizable material to form an insoluble polymer matrix bicontinuous with a plurality of nanovoids and a second solution, the plurality of nanovoids being filled with the second solution,

wherein a first volume fraction of the plurality of nanovoids proximate the first region of the coating is less than a second volume fraction of the plurality of nanovoids proximate the adjacent region of the coating; and

removing a major portion of the solvent from the second solution.

2. The process of claim 1, wherein the first environment comprises a polymerization inhibitor.

3. The process of claim 1, wherein an oxygen concentration proximate the first region that is greater than the oxygen concentration proximate the second region.

4. The process of claim 1, wherein a polymerization initiator concentration in the first region is less than the polymerization initiator concentration in the adjacent region.

5. The process of claim 1, further comprising an actinic radiation absorbing material in the first solution.

6. The process of claim 1, wherein removing a major portion of the solvent comprises drying in a thermal oven, drying with infrared or other radiant light sources, vacuum drying, gap drying, or a combination thereof.