

WHAT IS CLAIMED:

1. A method of conformally coating a biomaterial with a coating material, comprising the steps of:
 - (a) injecting an aqueous phase within a coaxial oil phase in a coating device configured to permit a transition from dripping to jetting and flow elongation of the aqueous phase within the oil phase;
 - (b) adding the biomaterial and the coating material to the aqueous phase, wherein the coating material of said step (b) does not comprise a viscosity-enhancing agent; and wherein the aqueous phase is at a pH of about 6 to about 7.4.
 - (c) allowing the aqueous phase jet to break up into particles; and
 - (d) adding a component of the coating material downstream of breakup of the aqueous phase jet into particles, wherein the component is a gelling emulsion that promotes or catalyzes polymerization of the coating material; thereby resulting in conformally coated biomaterial.
2. The method of claim 1, further comprising the step of collecting the outflow of the coating device.
3. The method of claims 1-2, further comprising the step of purifying the conformally coated biomaterial and biomaterial-free coating material from said oil phase.
4. The method of any one of claims 1-3, further comprising the step of separating the conformally coated biomaterial from the biomaterial-free coating material.
5. The method of any one of claims 1-4, wherein the biomaterial comprises cells, cell clusters, biomaterial-coated cells or cell-clusters, subcellular organelles, biologic molecules, non-biologic drugs, or a combination thereof.
6. The method of claim 5, wherein the biomaterial comprises cells or cell clusters.
7. The method of claim 6, wherein the biomaterial comprises islet cells or cell clusters.
8. The method of any one of claims 1-7, wherein the coating material comprises an agent selected from the group consisting of polyethylene glycol (PEG), polyethylene oxide (PEO), poly(N-vinyl pyrrolidinone) (PVP), polyethyl oxazoline, polyvinyl alcohol (PVA), polythioxazoline (PEOX), poly(amino acids), derivatives thereof and combinations thereof.

9. The method of claim 8, wherein the coating material comprises an agent selected from the group consisting of polyethylene glycol (PEG), PEG-maleimide, PEG-acrylate, and PEG-vinyl sulfone.
10. The method of claim 9, wherein the coating material comprises 5-10% PEG.
- 5 11. The method of claim 8, wherein the coating material comprises a multi-arm polyethylene glycol (PEG) minimally crosslinked (1-30%) with PEGdiThiol.
12. The method of any one of claims 1-11, wherein the aqueous phase comprises
- (a) serum-free media at pH 6-7.4; or
- (b) Hanks' Balanced Salt Solution (HBSS) at pH 6-7.4.
- 10 13. The method of claim 12, wherein the aqueous phase comprises about 200,000,000 islet cells/mL.
14. The method of claim 12, wherein the aqueous phase comprises about 100,000 cell clusters/mL.
15. The method of any one of claims 1-14, wherein the aqueous phase comprises a
- 15 thiolated reagent, a reducing reagent, a surfactant, or a combination thereof.
16. The method of claim 15, wherein the surfactant is polyoxyethylene-polyoxypropylene block copolymer or poly(ethylene glycol-bi-propylene sulfide).
17. The method of claim 16, wherein the surfactant is 2% polyoxyethylene-polyoxypropylene block copolymer.
- 20 18. The method of claim 15, wherein the reducing reagent is dithiothreitol (DTT) or PEGdiThiol.
19. The method of claim 18, wherein the reducing reagent is 0.01-0.62% dithiothreitol (DTT).
20. The method of any one of claims 1-19, wherein the gelling emulsion comprises
- 25 dithiothreitol (DTT) dissolved in Hanks' Balanced Salt Solution (HBSS) and emulsified in polypropylene glycol (PPG) with 10% sorbitan mono oleate (Span80).
21. The method of any one of claims 1-20, wherein the oil phase comprises polypropylene glycol (PPG).

22. The method of any one of claims 1-21, wherein the oil phase comprises polypropylene glycol (PPG), and 10% sorbitan mono oleate, and optionally triethanolamine.
23. The method of claim 22, wherein the oil phase comprises 0-0.2% triethanolamine.
24. The method of any one of claims 3-23, wherein purification of the conformally coated biomaterial and the biomaterial-free coating material from the oil phase comprises the step of
 5 (e) pouring the product from step (d) into mineral oil while stirring the resultant mixture.
25. The method of claim 24, wherein purification of the conformally coated biomaterial and the biomaterial-free coating material from the oil phase comprises the step of (f) adding Hanks' Balanced Salt Solution (HBSS) to the product resultant in step (e).
- 10 26. The method of claim 25, wherein the product of step (f) is centrifuged and washed with HBSS.
27. The method of claim 26, wherein after centrifugation and wash with Hanks' Balanced Salt Solution (HBSS), the coated biomaterial is incubated with a solution of PEGdithiol.
28. A biomaterial conformally coated by the method of any one of claims 1-27.
- 15 29. A method of treating a disorder in a patient, comprising the step of implanting into said patient the conformally coated biomaterial of claim 28.
30. The method of claim 29, wherein the disorder is diabetes.
31. A conformat coating device comprising:
- (1) an encapsulation chamber comprising:
- 20 (a) a housing portion coupled to a catheter via a first inlet at a first end of the housing portion and connected to a first pump;
- (b) an attachment portion comprising a first end configured to engage with an interior surface of a second end of the housing portion; and
- (c) a coating portion comprising a first end configured to engage with
 25 an exterior surface of a second end of the attachment portion, a chamber configured to coat, a second inlet coupled to a second pump, and a second end of the coating portion;
- wherein the catheter connected to the first pump is configured to inject a coating material and a biomaterial to be coated, in an aqueous phase to the first inlet on the internal side of the housing portion, wherein the aqueous phase comprises a pH level at or

between 6-7.4; and wherein the injected coating material does not comprise a viscosity enhancing agent;

wherein the second pump is configured to inject an oil phase comprising a surfactant to a second inlet on the external side of coating portion, wherein injection of the oil
5 phase is configured to flow coaxially to and externally to the internal aqueous phase;

(2) a capillary coupled to the second end of the coating portion, wherein the capillary is downstream of a point where the aqueous phase flow contacts with and elongates within the external oil phase to form a biphasic fluid that is configured to flow coaxially through the capillary from the coating portion; and

10 (3) a third pump coupled to the capillary and configured to inject a gelling emulsion coaxially to the capillary, wherein the emulsion comprises a catalyst for polymerization of the coating material in the aqueous phase.

32. The device of claim 31, wherein the first end of the coating portion substantially surrounds the second end of the attachment portion to form the chamber wherein the aqueous
15 phase flow contacts with the oil phase to form the biphasic fluid.

33. The device of claim 31 or 32, wherein the chamber comprises a tapered opening including a taper angle of an outlet nozzle configured for biphasic fluid to flow to the capillary, and wherein the second inlet is coupled with the chamber at the taper angle.

34. The device of any one of claims 31-33, wherein the first pump is a precision flow
20 syringe pump.

35. The device of any one of claims 31-33, wherein the second pump is a first peristaltic pump.

36. The device of any one of claims 31-33, wherein the third pump is a second peristaltic pump.