CLAIMS

1. A method for producing a poly(arylene ether) with improved particle size characteristics, the method comprising the step of:

(a) combining a first mixture comprising a poly(arylene ether) and a solvent with an anti-solvent to form a second mixture comprising the solvent, the anti-solvent, and the poly(arylene ether); and

wherein step (a) further comprises more than one process parameter selected from the group consisting of (b), (c), (d), (e) and (f):

(b) agitating the second mixture with a shear force generating device at an impeller tip speed of 6 m/s or less;

(c) providing the first mixture of step (a) with a solids content of approximately 10 to approximately 50 percent by weight of the poly(arylene ether) resin;

(d) maintaining a temperature of the second mixture at least 5 °C lower than the boiling point of the anti-solvent;

(e) providing a ratio of the anti-solvent to the first mixture by weight of approximately 0.5:1 to approximately 4:1; and

(f) providing the anti-solvent comprising no more than 5 percent water by weight; and

wherein the improved particle size characteristics includes one or both of: (i) up to about 50 weight percent of particles smaller than 38 micrometers; and a (ii) mean particle size greater than 100 or more micrometers.

2. The method of claim 1, wherein the first mixture is a homogeneous solution comprising the poly(arylene ether) and the solvent.

3. The method of claim 1 or 2, wherein the anti-solvent is selected from the group consisting of methanol, or methanol admixed with water.

4. The method of any of claims 1-3, wherein according to parameter (b), the impeller tip speed is 5 m/s or less.

5. The method of any of claims 1-4, wherein according to parameter (c), the solids content of the first mixture prior to addition of the anti-solvent to form the second mixture is approximately 20 percent to 40 percent by weight.

6. The method of any of claims 1-5, wherein according to parameter (e), the ratio of the anti-solvent to the first mixture by weight is approximately is 2:1 to 3:1.

7. The method of any of claims 1-6, comprising process parameters (b) and (c).

8. The method of any of claims 1-6, comprising process parameters (b), (c), and (e).

9. The method of any of claims 1-8, wherein step (a) comprises more than one process parameter selected from the group consisting of (b), (c), (d), (e) and (f):

(b) agitating the second mixture with a shear force generating device at an impeller tip speed of 4 m/s or less;

(c) providing the first mixture of step (a) with a solids content of approximately 20 to approximately 30 percent by weight of the poly(arylene ether) resin;

(d) maintaining a temperature of the second mixture between approximately 27 to 45 °C;

(e) providing a ratio of the anti-solvent to the first mixture by weight of approximately 1:1 to 3.5:1; and

(f) providing the anti-solvent comprising no more than 3 percent water by weight;

wherein the improved particle size characteristics include one or both of: (i) up to about 50 weight percent of particles smaller than 38 micrometers; and a (ii) mean particle size greater than 100 or more micrometers.

10. The method of claim 9, comprising process parameters (b), (c), and (e).

11. The method of any of claims 1-8, wherein step (a) comprises more than one process parameter selected from the group consisting of (b), (c), (d), (e) and (f):

(b) agitating the second mixture with a shear force generating device at an impeller tip speed of 3 m/s or less;

(c) providing the first mixture of step (a) with a solids content of approximately 20 to approximately 40 percent by weight of the poly(arylene ether) resin;

(d) maintaining a temperature of the second mixture less than 40 °C;

(e) providing a ratio of the anti-solvent to the first mixture by weight of approximately 1.75:1 to 3.25:1; and

(f) providing the anti-solvent comprising no more than 2 percent water by weight;

wherein the improved particle size characteristics include one or both of: (i) up to about 50 weight percent of particles smaller than 38 micrometers; and a (ii) mean particle size greater than 100 or more micrometers.

12. The method of claim 11, comprising process parameters (b), (c), and (e).

13. A polyphenylene ether comprising a poly(2,6-dimethyl-1,4-phenylene ether), wherein the polyphenylene ether contains a moiety derived from a morpholine-containing catalyst, wherein the particle size characteristics of the polyphenylene ether include one or both of: (i) up to about 50 weight percent of particles smaller than 38 micrometers; and a (ii) mean particle size greater than 100 or more micrometers.

14. A polyphenylene ether comprising a poly(2,6-dimethyl-1,4-phenylene ether), wherein the polyphenylene ether is essentially free of incorporated diphenoquinone residues, wherein the particle size characteristics of the polyphenylene ether include one or both of: (i) up to about 50 weight percent of particles smaller than 38 micrometers; and a (ii) mean particle size greater than 100 or more micrometers.

CLAIMS

1. A method for producing a poly(arylene ether) with improved particle size characteristics, the method comprising the step of:

(a) combining a first mixture comprising a poly(arylene ether) and a solvent, wherein the solvent is selected from the group consisting of toluene, xylenes, and mixtures thereof with an anti-solvent to form a second mixture comprising the solvent, the anti-solvent, and the poly(arylene ether), wherein the anti-solvent is selected from the group comprising of methanol, ethanol, isopropanol, methanol admixed with water, ethanol admixed with water, and isopropanol admixed with water; and

wherein step (a) further comprises process parameters (b), (c), (d), (e) and (f):

(b) agitating the second mixture with a shear force generating device at an impeller tip speed of 6 m/s or less;

(c) providing the first mixture of step (a) with a solids content of approximately 10 to approximately 50 percent by weight of the poly(arylene ether) resin;

(d) maintaining a temperature of the second mixture at least 5 °C lower than the boiling point of the anti-solvent;

(e) providing a ratio of the anti-solvent to the first mixture by weight of approximately 0.5:1 to approximately 4:1; and

(f) providing the anti-solvent comprising no more than 5 percent water by weight; and

wherein the improved particle size characteristics includes one or both of: (i) up to about 50 weight percent of particles smaller than 38 micrometers; and a (ii) mean particle size greater than 100 or more micrometers.

2. The method of claim 1, wherein the step (a) solvent comprises toluene.

3. The method of claim 1, wherein the first mixture is a homogeneous solution comprising the poly(arylene ether) and the solvent.

4. The method of claim 1, wherein the first mixture is a slurry comprising poly(arylene ether) and the solvent

5. The method of claim 1, wherein the temperature of the first mixture in step (a) is between approximately 30 °C and 100 °C.

6. The method of claim 5, wherein the temperature of the first mixture in step (a) is between approximately 40 °C and 90 °C.

7. The method of claim 6, wherein the temperature of the first mixture in step (a) is between approximately 50 °C and 70 °C.

8. The method of claim 1, wherein the anti-solvent in step (a) is combined with the first mixture using a stirred tank vessel or high-shear mixing pump.

9. The method of claim 1, wherein the anti-solvent is selected from the group consisting of methanol, or methanol admixed with water.

10. The method of claim 1, wherein according to parameter (b), the impeller tip speed is 5 m/s or less.

11. The method of claim 1, wherein according to parameter (b), the impeller tip speed is 4 m/s or less.

12. The method of claim 1, wherein according to parameter (b), the impeller tip speed is 3 m/s or less.

13. The method of claim 1, wherein according to parameter (c), the solids content of the first mixture prior to the addition of the anti-solvent is approximately 15 percent to 45 percent by weight.

14. The method of claim 1, wherein according to parameter (c), the solids content of the first mixture prior to addition of the anti-solvent to form the second mixture is approximately 20 percent to 40 percent by weight.

15. The method of claim 1, wherein according to parameter (c), the solids content of the first mixture is approximately 20 to 30 percent by weight.

16. The method of claim 1, wherein according to parameter (c), the solids content of the first mixture is approximately 10 to 35 percent or less by weight.

17. The method of claim 1, wherein according to parameter (d), the temperature of the second mixture is approximately 20 to 65 °C.

18. The method of claim 1, wherein according to parameter (d), the temperature of the second mixture is less than 60 °C.

19. The method of claim 1, wherein according to parameter (d), the temperature of the second mixture is less than 50 °C.

20. The method of claim 1, wherein according to parameter (d), the temperature of the second mixture is less than 40 °C.

21. The method of claim 1, wherein according to parameter (e), the ratio of the anti-solvent to the first mixture by weight is approximately 0.75:1 to approximately 3.75:1.

22. The method of claim 21, wherein according to parameter (e), the ratio of the anti-solvent to the first mixture by weight is approximately 1:1 to 3.5:1.

23. The method of claim 21, wherein according to parameter (e), the ratio of the anti-solvent to the first mixture by weight is approximately is 1.75:1 to 3.25:1.

24. The method of claim 21, wherein according to parameter (e), the ratio of the anti-solvent to the first mixture by weight is approximately is 2:1 to 3:1.

25. The method of claim 1, wherein according to parameter (f), the anti-solvent comprises 0 percent to approximately 4.5 percent by weight of water.

26. The method of claim 1, wherein according to parameter (f), the anti-solvent comprises 0 percent to approximately 3 percent by weight of water.

27. The method of claim 1, wherein according to parameter (f), the anti-solvent comprises 0 percent to approximately 2 percent by weight of water.

28. The method of claim 1, comprising two or more of the process parameters selected from the group consisting of (b), (c), (d), (e) and (f).

29. The method of claim 1, comprising three or more of the process parameters selected from the group consisting of from (b), (c), (d), (e) and (f).

30. The method of claim 1, comprising four or more of the process parameters selected from the group consisting of (b), (c), (d), (e) and (f).

31. The method of claim 1, comprising process parameters (b), (c), (d), (e) and (f):

(b) agitating the second mixture with a shear force generating device at an impeller tip speed of 4 m/s or less;

(c) providing the first mixture of step (a) with a solids content of approximately 20 to approximately 30 percent by weight of the poly(arylene ether) resin;

(d) maintaining a temperature of the second mixture between approximately 27 to 45 °C;

(e) providing a ratio of the anti-solvent to the first mixture by weight of approximately 1:1 to 3.5:1; and

(f) providing the anti-solvent comprising no more than 3 percent water by weight; wherein the improved particle size characteristics include one or both of: (i) up to about 50 weight percent of particles smaller than 38 micrometers; and a (ii) mean particle size greater than 100 or more micrometers.

32. The method of claim 1, comprising process parameters (b), (c), (d), (e) and (f):

(b) agitating the second mixture with a shear force generating device at an impeller tip speed of 3 m/s or less;

(c) providing the first mixture of step (a) with a solids content of approximately 20 to approximately 40 percent by weight of the poly(arylene ether) resin;

(d) maintaining a temperature of the second mixture less than 40 °C;

(e) providing a ratio of the anti-solvent to the first mixture by weight of approximately 1.75:1 to 3.25:1; and

(f) providing the anti-solvent comprising no more than 2 percent water by weight; wherein the improved particle size characteristics include one or both of: (i) up to about 50 weight percent of particles smaller than 38 micrometers; and a (ii) mean particle size greater than 100 or more micrometers.

33. The method of claim 1, wherein the improved particle size characteristics include up to approximately 40 weight percent of particles smaller than 38 micrometers.

34. The method of claim 1, wherein the improved particle size characteristics include a mean particle size of greater than 150 micrometers.

35. The method of claim 1, wherein the improved particle size characteristics include up to approximately 30 weight percent of particles smaller than 38 micrometers.

36. The method of claim 1, the particle size characteristics include a mean particle size of greater than 175 micrometers.

37. The method of claim 1, wherein the improved particle size characteristics include up to approximately 20 weight percent of particles smaller than 38 micrometers.

38. The method of claim 1, wherein the improved particle size characteristics include a mean particle size of greater than 200 micrometers.

39. The method of claim 1, wherein the poly(arylene ether) comprises polyphenylene ether.

40. The method of claim 1, further comprising the step of forming the poly (arylene ether) of step (a) by oxidatively coupling a monomer comprising a monohydric phenol using an oxygen containing gas and a complex metal catalyst in a solvent to produce the poly(arylene ether) resin as a mixture in the solvent.

41. The method of claim 1, further comprising the step of isolating the poly(arylene ether) with improved particle size characteristics.

42. A polyphenylene ether comprising a poly(2,6-dimethyl-1,4-phenylene ether), wherein the polyphenylene ether contains a moiety derived from a morpholine-containing catalyst, wherein the particle size characteristics of the polyphenylene ether include one or both of: (i) up to about 50 weight percent of particles smaller than 38 micrometers; and a (ii) mean particle size greater than 100 or more micrometers.

43. A polyphenylene ether comprising a poly(2,6-dimethyl-1,4-phenylene ether), wherein the polyphenylene ether is essentially free of incorporated diphenoquinone residues, wherein the particle size characteristics of the polyphenylene ether include one or both of: (i) up to about 50 weight percent of particles smaller than 38 micrometers; and a (ii) mean particle size greater than 100 or more micrometers.