CLAIMS

1. A polymer having at least the following characteristics:

(a) a block styrene content containing 4 to 6 styrene units from about 27 to about 50 weight percent based on total styrene content in the polymer;

(b) a vinyl content from about 30 to about 80 weight percent based on total amount of polymerized 1,3-butadiene; and

(c) a styrene content from about 40 to about 70 weight percent based on total weight of polymer

2. The polymer of claim 1 having a block styrene content with more than 6 consecutive styrene units of less than about 25 weight percent based on total styrene content in the polymer, preferably having a block styrene content with more than 6 consecutive styrene units of less than about 10 weight percent based on total styrene content in the polymer.

3. The polymer as in any of the preceding claims having an amount of styrene incorporated with fewer than 4 consecutive styrene units of between about 30 and about 73 weight percent based on total styrene content, preferably between about 35 and about 70.

4. The polymer as in any of the preceding claims produced using a batch process and having a molecular weight distribution (Mw/Mn) from about 1.05 to about 2, preferably from about 1.1 to about 1.8, more preferably from about 1.2 to about 1.6.

5. The polymer as in any of the preceding claims produced using a continuous process and having a molecular weight distribution (Mw/Mn) from about 1.5 to about 2.5, preferably from about 1.6 to about 2.4, more preferably from about 1.8 to about 2.2.

6. The polymer as in any of the preceding claims having a number-average molecular weight greater than or equal to about 80,000 g/mole, preferably greater than or equal to about 150,000 g/mole, and more preferably greater than or equal to about 300,000 g/mole.

7. The polymer as in any of the preceding claims having a weight-average molecular weight greater than or equal to about 84,000 g/mole, preferably greater than or equal to about 155,000 g/mole, and more preferably greater than or equal to about 310,000 g/mole.

8. The polymer as in any of the preceding claims having a Mooney viscosity from about 20 to about 150, preferably from about 30 to about 120, more preferably from about 30 to about 90.

9. A composition comprising the polymer as in any of the preceding claims.

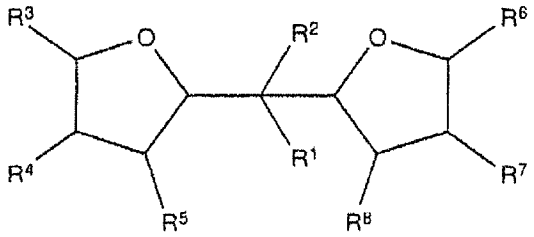
10. The composition of claim 9 further comprising an oil in an amount from about 5 to about 40 weight percent based on weight of the polymer.

11. An article comprising at least one component formed from the composition of claim 9 or claim 10.

12. A process for polymerization of a polymer comprising monomeric units derived from a styrene monomer and a 1,3-butadiene monomer, the process comprising:

polymerizing the monomeric units in the presence of an initiator and a polar agent;

wherein the polar agent comprises a structure I:



(I);

wherein R^1 and R^2 are each independently an alkyl group;

wherein R^3, R^4, R^5, R^6, R^7 and R^8 are each independently selected from the group consisting of an alkyl group and hydrogen;

wherein a molar ratio of the polar agent to active initiator is greater than about 0.5;

wherein styrene content of a monomer mixture added in the polymerization is greater than about 40 weight percent based on total weight of added monomers; and

wherein the polymerization is run at a temperature of less than about 80 °C.

13. The process of claim 12 wherein R^1 and R^2 are each independently a C_1-C_4 alkyl group, preferably methyl.

14. The process as in claim 12 or 13 wherein R^3, R^4, R^5, R^6, R^7 and R^8 are each independently selected from the group consisting of hydrogen and a C_1-C_4 alkyl group.

15. The process as in any of claims 12-14 wherein the polar agent comprises ditetrahydrofurylpropane.

16. The process as in any of claims 12-15 wherein the initiator comprises n-butyl lithium.

17. The process as in any of claims 12-16 wherein total monomer conversion is greater than about 96 weight percent based on total amount of

monomer feed, preferably greater than about 98 weight percent, and more preferably greater than about 99 weight percent.

18. The process as in any of claims 12-17 wherein the polymer comprises a vinyl content from about 30 to about 80 weight percent based on total amount of polymerized 1,3-butadiene, preferably from about 40 to about 70 weight percent.

19. The process as in any of claims 12-18 wherein the molar ratio of the polar agent to active initiator is between about 0.5 and about 10.

20. The process as in any of claims 12-19 wherein the polymerization is run at a temperature of between about 10 °C and about 80 °C, preferably between 20 °C and 75°C.

21. The process as in any of claims 12-20 wherein the polymer has a block styrene content containing 4 to 6 styrene units from about 27 to about 50 weight percent based on total styrene content in the polymer.

22. The process as in any of claims 12-21 wherein the polymer has a block styrene content with more than 6 consecutive styrene units of less than about 25 weight percent based on total styrene content in the polymer, preferably wherein the polymer has a block styrene content with more than 6 consecutive styrene units of less than about 10 weight percent based on total styrene content in the polymer.

23. The process as in any of claims 12-22 wherein the polymerizing takes place in a hydrocarbon solvent.

CLAIMS

1. A polymer comprising:

(a) a block styrene content containing 4 to 6 styrene units from about 27 to about 50 weight percent based on total styrene content in the polymer;

(b) a vinyl content from about 30 to about 80 weight percent based on total amount of polymerized 1,3-butadiene; and

(c) a styrene content from about 40 to about 70 weight percent based on total weight of polymer.

2. The polymer of claim 1 having a block styrene content with more than 6 consecutive styrene units of less than about 25 weight percent based on total styrene content in the polymer.

3. The polymer of claim 1 having an amount of styrene incorporated with fewer than 4 consecutive styrene units of between about 30 and about 73 weight percent based on total styrene content.

4. The polymer of claim 1 produced using a batch process and having a molecular weight distribution (Mw/Mn) from about 1.05 to about 2.

5. The polymer of claim 1 produced using a continuous process and having a molecular weight distribution (Mw/Mn) from about 1.5 to about 2.5.

6. The polymer of claim 1 having a number-average molecular weight greater than or equal to about 80,000 g/mole.

7. The polymer of claim 1 having a weight-average molecular weight greater than or equal to about 84,000 g/mole.

8. The polymer of claim 1 having a Mooney viscosity from about 20 to about 150.

9. A composition comprising the polymer of claim 1.

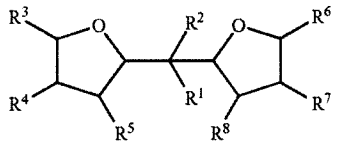
10. The composition of claim 9 further comprising an oil in an amount from about 5 to about 40 weight percent based on weight of the polymer.

11. An article comprising at least one component formed from the composition of claim 9.

12. A process for polymerization of a polymer comprising monomeric units derived from a styrene monomer and a 1,3-butadiene monomer, the process comprising:

polymerizing the monomers in the presence of an initiator and a polar agent;

wherein the polar agent comprises a structure I:



(I)

wherein R^1 and R^2 are each independently an alkyl group;

wherein R^3, R^4, R^5, R^6, R^7 and R^8 are each independently selected from the group consisting of an alkyl group and hydrogen;

wherein a molar ratio of the polar agent to active initiator is greater than 0.5;

wherein styrene content of a monomer mixture added in the polymerization is greater than about 40 weight percent based on total weight of added monomers; and

wherein the polymerization is run at a temperature of less than about 80 °C.

13. The process of claim 12 wherein R^1 and R^2 are each independently a C_1-C_4 alkyl group.

14. The process of claim 12 wherein R^3, R^4, R^5, R^6, R^7 and R^8 are each independently selected from the group consisting of hydrogen and a C_1-C_4 alkyl group.

15. The process of claim 12 wherein the polar agent comprises ditetrahydrofurylpropane.

16. The process of claim 12 wherein the initiator comprises n-butyl lithium.

17. The process of claim 12 wherein total monomer conversion is greater than about 96 weight percent based on total amount of monomer feed.

18. The process of claim 12 wherein the polymer comprises a vinyl content from about 30 to about 80 weight percent based on total amount of polymerized 1,3-butadiene.

19. The process of claim 12 wherein the molar ratio of the polar agent to active initiator is between about 0.5 and about 10.

20. The process of claim 12 wherein the polymerization is run at a temperature of between about 10°C and about 80°C.

21. The process of claim 12 wherein the polymer has a block styrene content containing 4 to 6 styrene units from about 27 to about 50 weight percent based on total styrene content in the polymer.

22. The process of claim 12 wherein the polymer has a block styrene content with more than 6 consecutive styrene units of less than about 25 weight percent based on total styrene content in the polymer.

23. The process of claim 12 wherein the polymerizing takes place in a hydrocarbon solvent.