CLAIMS

1. A polymer having at least the following characteristics:

(a) a block styrene content with more than 4 consecutive styrene units from about 40 to about 70 weight percent based on total styrene content in the polymer;

(b) a vinyl content from about 25 to about 80 weight percent based on total amount of polymerized 1,3-diene;

(c) a styrene content from about 20 to about 75 weight percent based on total weight of polymer; and

(d) a molecular weight distribution (Mw/Mn) of 1.5 or less.

2. The polymer of claim 1 having a block styrene content with more than 6 consecutive styrene units of from about 5 to about 30 weight percent based on total styrene content in the polymer, preferably the polymer has a block styrene content with more than 6 consecutive styrene units of from about 19 to about 26 weight percent based on total styrene content in the polymer.

3. The polymer as in any of the preceding claims having a styrene content of between about 25 and about 65 weight percent based on total styrene content, preferably between about 50 and about 60.

4. The polymer as in any of the preceding claims having a molecular weight distribution (Mw/Mn) from about 1.05 to about 1.5, preferably from about 1.1 to about 1.4, more preferably from about 1.2 to about 1.4.

5. The polymer as in any of the preceding claims wherein the 1,3-diene comprises 1,3-butadiene.

6. The polymer as in any of the preceding claims having a number-average molecular weight (Mn) greater than or equal to about 200,000 g/mole, preferably greater than or equal to about 400,000 g/mole, and more preferably greater than or equal to about 550,000 g/mole and/or a weight-average molecular weight (Mw) greater than or equal to about 300,000 g/mole, preferably greater than or equal to about 500,000 g/mole, and more preferably greater than or equal to about 600,000 g/mole.

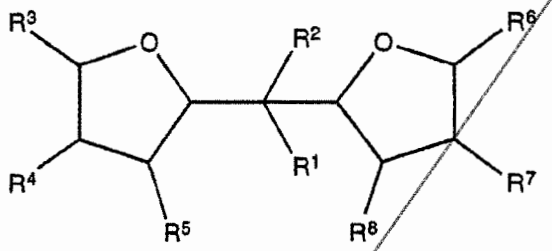
7. A composition comprising the polymer as in any of the preceding claims and optionally at least one additive.

8. An article comprising at least one component formed from the composition of claim 7.

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

polymerizing the monomeric units in the presence of an initiator such as n-butyllithium, a potassium alcoholate 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.

10. The process of claim 9 wherein R^1 and R^2 are each independently a C_1-C_4 alkyl group, preferably methyl and/or 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.

11. The process as in any of claims 9 or 10 wherein the polar agent comprises ditetrahydrofurylpropane.

12. The process as in any of claims 9 to 11 wherein the potassium alcoholate comprises potassium-3,7-dimethyl-3-octylate.

13. The process as in any of claims 9 to 10 wherein the molar ratio of the potassium salt to active initiator is between about 0.05 and about 5, preferably between about 0.1 and about 1.

14. The process as in any of claims 9 to 13 wherein the polymerization is run at a temperature of about 80 °C or less, preferably between about 10 °C and about 80 °C, more preferably between 20 °C and 75 °C and/or the molar ratio of the polar agent to the potassium alcoholate is between about 30:1 and about 1:5, preferably between about 15:1 and 1:1.5 and/or the molar ratio of polar agent to active initiator is between about 0.1 and about 3, preferably between about 0.2 and about 1.5.

15. The process as in any of claims 9 to 14 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.

CLAIMS

1. A polymer having at least the following characteristics:

(a) a block styrene content with more than 4 consecutive styrene units from 40 to 70 weight percent based on total styrene content in the polymer;

(b) a vinyl content from 25 to 80 weight percent based on total amount of polymerized 1,3-diene;

(c) a styrene content from 20 to 75 weight percent based on total weight of polymer; and

(d) a molecular weight distribution (Mw/Mn) of 1.5 or less, wherein the polymer has a weight-average molecular weight (Mw) of greater than or equal to 250,000 g/mole.

2. The polymer of claim 1 having a block styrene content with more than 6 consecutive styrene units of from 5 to 30 weight percent based on total styrene content in the polymer, preferably the polymer has a block styrene content with more than 6 consecutive styrene units of from 19 to 26 weight percent based on total styrene content in the polymer.

3. The polymer as in any of the preceding claims having a styrene content of between 25 and 65 weight percent based on total styrene content, preferably between 50 and 60.

4. The polymer as in any of the preceding claims having a molecular weight distribution (Mw/Mn) from 1.05 to 1.5, preferably from 1.1 to 1.4, more preferably from 1.2 to 1.4.

5. The polymer as in any of the preceding claims wherein the 1,3-diene comprises 1,3-butadiene.

6. The polymer as in any of the preceding claims having a number-average molecular weight (Mn) greater than or equal to 200,000 g/mole, preferably greater than or equal to 400,000 g/mole, and more preferably greater than or equal to 550,000 g/mole and/or a weight-average molecular weight (Mw) greater than or equal to 300,000 g/mole, preferably greater than or equal to 500,000 g/mole, and more preferably greater than or equal to 600,000 g/mole.

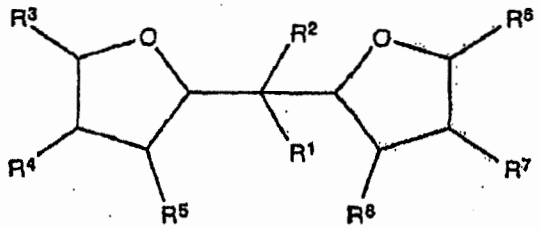
7. A composition comprising the polymer as in any of the preceding claims and optionally at least one additive.

8. An article comprising at least one component formed from the composition of claim 7.

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

polymerizing the monomeric units in the presence of an initiator such as n-butyllithium, a potassium alcoholate 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; and wherein the potassium alcoholate comprises potassium-3,7-dimethyl-3-octylate.

10. The process of claim 9 wherein R^1 and R^2 are each independently a C_1-C_4 alkyl group, preferably methyl and/or 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.

11. The process as in any of claims 9 or 10 wherein the polar agent comprises ditetrahydrofurylpropane.

12. The process as in any of claims 9 to 10 wherein the molar ratio of the potassium salt to active initiator is between 0.05 and 5, preferably between 0.1 and 1.

13. The process as in any of claims 9 to 12 wherein the polymerization is run at a temperature of 80 °C or less, preferably between 10 °C and 80 °C, more preferably between 20 °C and 75 °C and/or the molar ratio of the polar agent to the potassium alcoholate is between 30:1 and 1:5, preferably between 15:1 and 1:1.5 and/or the molar ratio of polar agent to active initiator is between 0.1 and 3, preferably between 0.2 and 1.5.

14. The process as in any of claims 9 to 13 wherein total monomer conversion is greater than 96 weight percent based on total amount of monomer feed, preferably greater than 98 weight percent, and more preferably greater than 99 weight percent.