VINYL ETHER END-FUNCTIONALIZED POLYOLEFINS

1. FIELD

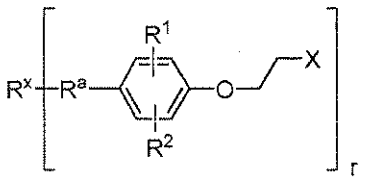
[0001] Provided herein are vinyl ether end-functionalized polyolefins and methods for producing the same.

2. BACKGROUND

[0002] Telechelic polymers are polymers that contain one or more functional groups at the end of the polymer. These functional groups are reactive to other molecules, thereby allowing derivatization of the polymer at its chain ends. Thus, telechelic polymers serve as useful intermediates for the preparation of a diverse range of desirable polymeric products, including high performance polymers such as, but not limited to, fuel or lube oil additives, network polymers, star-branched polymers, and graft and block co-polymers. Provided herein are telechelic polymers that have vinyl ether chain ends and methods for producing the same.

3. SUMMARY

[0003] In some embodiments, provided herein are methods for preparing a telechelic polymer comprising contacting a compound of formula I:



I

with a base, wherein:

R^1 and R^2 are each, independently, H, alkyl, or alkoxy;

R^a is a polyisobutylene group;

R^x is an initiator residue;

r is an integer from 1 to 4; and

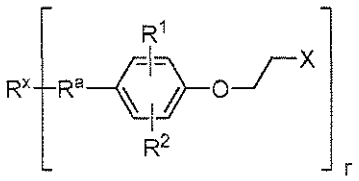
X is a -Cl, -Br, -I, or -OC(O)R, wherein R is alkyl, alkenyl, alkynyl, alkaryl, aryl, or heteroaryl.

[0003a] In one aspect, there is provided a product formed by the method as defined herein.

[0004] In some embodiments, the compound of formula I contacts with the base to form a compound of formula II:

WHAT IS CLAIMED:

1. A method for preparing a telechelic polymer comprising contacting a compound of formula I:



I

with a base, wherein:

R^1 and R^2 are each, independently, H, alkyl, or alkoxy;

R^a is a polyisobutylene group;

R^x is an initiator residue;

r is an integer from 1 to 4;

and X is -Cl, -Br, -I, or -OC(O)R, wherein R is alkyl, alkenyl, alkynyl, alkaryl, aryl, or heteroaryl.

2. The method of claim 1, wherein R^1 and R^2 are H.

3. The method of claim 1, wherein X is -Cl.

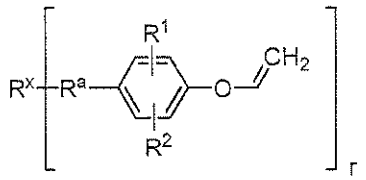
4. The method of claim 1, wherein the base is a metal hydroxide or metal alkoxide.

5. The method of claim 4, wherein the base is MOR, wherein M is sodium or potassium, and R is H or alkyl.

6. The method of claim 5, wherein the O is bonded to R on a secondary or tertiary carbon.

7. The method of claim 5, wherein the base is potassium tert-butoxide.

8. The method of claim 1, wherein the compound of formula I contacts with the base to form a compound of formula II:



II

wherein:

R^1 and R^2 are each, independently, H, alkyl, or alkoxy;

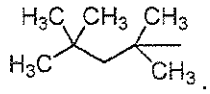
R^a is a polyisobutylene group;

R^x is an initiator residue; and

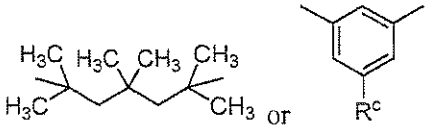
r is an integer from 1 to 4.

9. The method of claim 1, wherein r is 1.

10. The method of claim 1, wherein r is 1 and R^x is



11. The method of claim 1, wherein r is 2 and R^x is



wherein R^c is H or alkyl.

12. The method of claim 1, wherein the method is performed in the presence of a diluent.

13. The method of claim 12, wherein the diluent is a mixture of a non-polar solvent and an aprotic dipolar solvent.

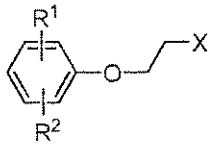
14. The method of claim 13, wherein the non-polar solvent is a heptane and the aprotic dipolar solvent is N,N-dimethylformamide.

15. The method of claim 13, wherein the method is performed at refluxing temperature.

16. The method of claim 1, wherein the compound of formula I is formed by

(a) generating a quasiliving carbocationic polyolefin; and

(b) reacting the quasiliving carbocationic polyolefin from step (a) with one or more Lewis acids compounds of formula III in the presence of a Lewis acid or mixture of acids under quasiliving carbocationic polymerization conditions:



III

wherein R^1 and R^2 are each, independently, H, alkyl, or alkoxy; and

X is -Cl, -Br, -I, or -OC(O)R, wherein R is alkyl, alkenyl, alkynyl, alkaryl, aryl, or heteroaryl.

17. The method of claim 16, wherein the quasiliving carbocationic polyolefin is prepared by adding a Lewis acid and a monomer to an initiator in the presence of an electron donor, common ion salt, or common ion salt precursor.

18. The method of claim 17, wherein the initiator is 2-chloro-2,4,4-trimethylpentane.

19. The method of claim 17, wherein the monomer is isobutylene.

20. The method of claim 17, wherein the electron donor is 2,6-lutidine.

21. The method of claim 17, wherein the Lewis acid is a titanium tetrahalide.

22. The method of claim 16, wherein steps (a) and (b) are performed in the presence of a diluent.

23. The method of claim 22, wherein the diluent is a mixture of hexanes and methyl chloride.

24. A product formed by the method of claim 1.

wherein n is an integer from 1 to 10,000.

33. The compound of claim 32, wherein n is an integer from 10 to 10,000.

34. The compound of claim 32, wherein n is an integer from 100 to 10,000.

35. The compound of claim 26, wherein the number average molecular weight of the compound is from 1.0×10^3 to 3.0×10^3 g/mol.

36. The compound of claim 26, wherein the polydispersity index of the compound is less than 1.3.