What is claimed is:

1. A process for the preparation of polybutene having an exo-olefin content of at least 50 mol. %, which process comprises contacting isobutene or an isobutene-containing monomer mixture, with a Lewis acid catalyst complexed with an oxygen and/or sulfur-containing Lewis base, in a substantially or completely apolar solvent, and initiating polymerization of said isobutene or an isobutene-containing monomer mixture with an initiator, wherein said Lewis acid catalyst is a Lewis acid of the formula MR"mYn, wherein M is a metal selected from Al, Fe, Ga, Hf, Zr and W; R" is a hydrocarbyl group; Y is halogen; m is 0 or an integer of 1 to 5; and n is an integer of 1 to 6, with the proviso that m+n is equal to the valency of metal M; said Lewis base is dihydrocarbyl ether, wherein each ether hydrocarbyl group is independently selected from C1 to C8 hydrocarbyl, wherein one or each of said ether hydrocarbyl groups are substituted, on a carbon atom other than the carbon atom adjacent to the oxygen atom of the ether group, with an electron-withdrawing group; the initiator is a compound of the formula RX, wherein X is a halide; R is a hydrocarbyl group capable of forming a stable carbocation, and wherein the carbon linking group R to group X is tertiary, benzylic or allylic.

2. The process of claim **1**, wherein M is Ga or Fe, and R" is a C1 to C8 alkyl group.

3. The process of claim **1**, wherein m is 0 or 1.

4. The process of claim **1**, wherein Y is Cl or Br.

5. The process of claim **1**, wherein said ether hydrocarbyl groups are alkyl groups.

6. The process of claim **5**, wherein said ether hydrocarbyl groups are C1 to C4 alkyl groups.

7. The process of claim **1**, wherein said electron-withdrawing group is a halogen atom.

8. The process of claim **7**, wherein said electron-withdrawing group is a chlorine atom.

9. The process of claim **5**, wherein said electron-withdrawing group is a halogen atom.

10. The process of claim **9**, wherein said electron-withdrawing group is a chlorine atom.

11. The process of claim **1**, wherein said isobutene or an isobutene-containing monomer mixture is selected from pure isobutene; a C4 refinery cut containing between about 5% and about 50% butene-1, between about 2% and about 40% butene-2, between about 2% and about 60% iso-butane, between about 2% and about 20% n-butane, and up to about 0.5% butadiene, wherein all percentages are by mass, based on the total mass of the C4 refinery cut; and mixtures of pure isobutene and said C4 refinery cut.

12. The process of claim **1**, wherein said complex is contacted with said isobutene or an isobutene-containing monomer at a concentration of millimoles of Lewis acid-Lewis base complex per liter of medium of from about 1 mM to about 200 mM.

13. The process of claim **1**, wherein said Lewis acid and said Lewis base are complexed by dissolving the Lewis acid in solvent to form a solution, and then adding said Lewis base to said solution.

14. The process of claim **1**, wherein the polymerization process is conducted continuously.

15. The process of claim **1**, wherein said polybutene product has an exo-olefin content of at least 70 mol. %.

16. A catalyst-initiator system for catalyzing the polymerization of isobutene or an isobutene-containing monomer mixture in a substantially or completely apolar solvent to provide a polybutene product having an exo-olefin content of at least 50 mol. %, wherein said catalyst comprising a Lewis acid catalyst complexed with a Lewis base, wherein said Lewis acid catalyst is a Lewis acid of the formula MR"mYn, wherein M is a metal selected from Al, Fe, Ga, Hf, Zr and W; R" is a hydrocarbyl group; Y is halogen; m is 0 or an integer of 1 to 5; and n is an integer of 1 to 6, with the proviso that m+n is equal to the valency of metal M; said Lewis base is dihydrocarbyl ether, wherein each ether hydrocarbyl group is independently selected from C1 to C8 hydrocarbyl, wherein one or each of said ether hydrocarbyl groups are substituted, on a carbon atom other than the carbon atom adjacent to the oxygen atom of the ether group, with an electron-withdrawing group; and the polymerization is initiated via an initiator of the formula RX, wherein X is a halide; R is a hydrocarbyl group capable of forming a stable carbocation, and wherein the carbon linking group R to group X is tertiary, benzylic or allylic.

17. The catalyst-initiator system of claim **16**, wherein M is Ga or Fe, and R" is a C1 to C8 alkyl group.

18. The catalyst-initiator system of claim **16**, wherein m is 0 or 1.

19. The catalyst-initiator system of claim **16**, wherein Y is Cl or Br.

20. The catalyst-initiator system of claim **16**, wherein said ether hydrocarbyl groups are alkyl groups.

21. The catalyst-initiator system of claim **20**, wherein said ether hydrocarbyl groups are C1 to C4 alkyl groups.

22. The catalyst-initiator system of claim **16**, wherein said electron-withdrawing group is a halogen atom.

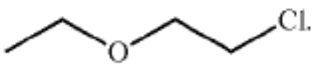
23. The catalyst-initiator system of claim **22**, wherein said electron-withdrawing group is a chlorine atom.

24. The catalyst-initiator system of claim **21**, wherein said electron-withdrawing group is a halogen atom.

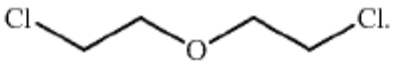
25. The catalyst-initiator system of claim **24**, wherein said electron-withdrawing group is a chlorine atom.

26. The catalyst-initiator system of claim **16**, wherein said Lewis acid and said Lewis base are complexed by dissolving the Lewis acid in solvent to form a solution, and then adding said Lewis base to said solution.

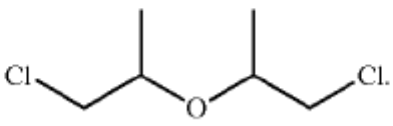
27. The catalyst-initiator system of claim **10**, wherein the Lewis base has the structural formula of:



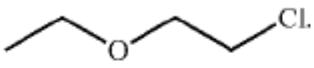
28. The catalyst-initiator system of claim **10**, wherein the Lewis base has the structural formula of:



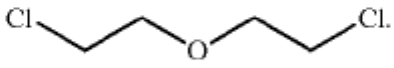
29. The catalyst-initiator system of claim **10**, wherein the Lewis base has the structural formula of:



30. The catalyst-initiator system of claim **25**, wherein the Lewis base has the structural formula of:



31. The catalyst-initiator system of claim **25**, wherein the Lewis base has the structural formula of:



32. The catalyst-initiator system of claim **25**, wherein the Lewis base has the structural formula of:

