CLAIMS:

1. A process for the preparation of polybutene having an exo-olefin content of at least 50 mol. % from an isobutene or an isobutene-containing monomer feedstock, which process comprises contacting said isobutene or isobutene-containing feedstock, with a Lewis acid catalyst complexed with a Lewis base, in a substantially or completely apolar polymerization medium, and initiating polymerization of said isobutene or isobutene-containing feedstock with an initiator, wherein said Lewis acid catalyst is a Lewis acid of the formula $R'AlCl_2$, wherein R' is a hydrocarbyl group; said Lewis base is a dihydrocarbyl ether wherein each hydrocarbyl group is independently selected from hydrocarbyl groups having 1 to 8 carbon atoms and one or both hydrocarbyl groups of the dihydrocarbyl ether are substituted with an electron withdrawing group and 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 the carbon linking group R to group X is tertiary, benzylic or allylic; wherein the catalyst complex is pre-activated by addition of water, and the pre-activated catalyst complex is subsequently reacted with from about 0.1 to about 2 molar equivalents, per equivalent of Lewis acid, of a trialkyl aluminum compound wherein each alkyl group of said trialkyl aluminum compound has at least 2 carbon atoms.

2. The process of claim 1, wherein R' is an alkyl group having 1 to 12 carbons.

3. The process of claim 1, wherein said Lewis base is dihydrocarbyl ether wherein each hydrocarbyl group is independently selected from hydrocarbyl groups having 1 to 8 carbon atoms and one or both hydrocarbyl groups of the dihydrocarbyl ether are substituted with a chlorine atom.

4. The process of claim 3, wherein said Lewis base is a dihydrocarbyl ether wherein each hydrocarbyl group is independently selected from alkyl groups having 1 to 4 carbon atoms and one or both hydrocarbyl groups of the dihydrocarbyl ether are substituted with a chlorine atom.

5. The process of claim 1, wherein the Lewis acid and Lewis base are complexed in a solvent selected from mixed C_4 to C_{12} linear and/or branched hydrocarbons, toluene or xylene.

6. The process of claim 1, wherein said apolar polymerization medium is selected from saturated C_4 hydrocarbons, unsaturated C_4 hydrocarbons, and mixtures thereof.

7. The process of claim 1, wherein said isobutene or isobutene-containing feedstock is selected from pure isobutene; a C_4 refinery cut containing between about 20-50% isobutene, between 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 C_4 refinery cut; and mixtures of pure isobutene and said C_4 refinery cut.

8. The process of claim 1, wherein said catalyst complex is pre-activated by addition of from about 0.02 to about 10 equivalents, per equivalent of Lewis acid, of water.

9. The process of claim 1, wherein said Lewis acid catalyst complexed with a Lewis base, is contacted with said isobutene or isobutene-containing feedstock at a concentration of millimoles of Lewis acid-Lewis base complex per liter of feedstock of from about 0.2 mM to about 200 mM.

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

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

12. The process of claim 1, wherein said polybutene product has a number average molecular weight (M_n) of from about 400 Daltons to about 4000 Daltons.

13. The process of claim 1, wherein said trialkyl aluminum compound is selected from the group consisting of trioctyl aluminum, triisobutyl aluminum, triethyl aluminum, and mixtures thereof.