

Listing of the Claims:

1. A method of producing a polyether polyol, comprising:
reacting a low molecular weight initiator with one or more monomers in the presence of a polymerization catalyst, the low molecular weight initiator having a nominal hydroxyl functionality of at least 2, the one or more monomers being at least one selected from propylene oxide and butylene oxide, and the polymerization catalyst being a Lewis acid catalyst having the general formula $M(R^1)_1(R^2)_1(R^3)_1(R^4)_{0 \text{ or } 1}$, whereas M is boron, aluminum, indium, bismuth or erbium, R^1 , R^2 and R^3 each includes a same fluoroalkyl-substituted phenyl group, and optional R^4 includes a functional group or functional polymer group; and
forming a polyether polyol having a number average molecular weight of greater than the number average molecular weight of the low molecular weight initiator in the presence of the Lewis acid catalyst.
2. The method as claimed in claim 1, wherein the Lewis acid catalyst has the general formula $M(R^1)_1(R^2)_1(R^3)_1(R^4)_{0 \text{ or } 1}$, whereas M is boron, and each of R^1 , R^2 , and R^3 is a 3,4- or 3,5-bis(fluoroalkyl)-substituted phenyl group.
3. The method as claimed in claim 1, wherein the Lewis acid catalyst has the general formula $M(R^1)_1(R^2)_1(R^3)_1(R^4)_{0 \text{ or } 1}$, whereas M is boron, and each of R^1 , R^2 , and R^3 is a fluoro/chloro-fluoroalkyl-substituted phenyl group, difluoro/chloro-fluoroalkyl-substituted phenyl group, trifluoro/chloro-fluoroalkyl-substituted phenyl group, or tetrafluoro/chloro-fluoroalkyl-substituted phenyl group.
4. The method as claimed in any one of claims 1 to 3, wherein the Lewis acid catalyst has the general formula $M(R^1)_1(R^2)_1(R^3)_1(R^4)_1$.
5. The method as claimed in claim 4, wherein R^4 is a cyclic ether having 3-10 carbon atoms.
6. The method as claimed in claim 4, wherein R^4 is a ketone having 3-10 carbon atoms.

7. The method as claimed in any one of claims 1 to 6, wherein the polyether polyol has an acetal content of less than 0.5 mol% based on a total number of moles of the polyether polyol.

8. The method as claimed in any one of claims 1 to 7, wherein the low molecular weight initiator is a polyether diol or triol derived from at least one selected from propylene oxide, ethylene oxide, and butylene oxide.

9. A method of producing a polyurethane product, the method comprising:
providing a polyether polyol produced according to the method as claimed in any one of claims 1 to 8, and
providing an isocyanate.

10. A polyether polyol prepared using the method as claimed in any one of claims 1 to 8.

11. A polyurethane product prepared using the polyether polyol as claimed in claim 10.