

Summary

[0008] Examples may be realized by providing a method of producing a polyether polyol that includes 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 at least 2, the one or more monomers including 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. The method further includes 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.

[0008a] In one aspect, the present disclosure refers to 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, R^1 , R^2 and R^3 each 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, and optional R^4 includes a functional group or functional polymer group, said functional group or functional polymer group being a molecule that contains at least one of the following: water, an alcohol, an alkoxy, a ketone, an ester, an organosiloxane, an amine, a phosphine, an oxime, and substituted analogs thereof; 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.

[0008b] In another aspect, the present disclosure refers to 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 $M(R^1)_1(R^2)_1(R^3)_1(R^4)_1$, 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 R^4 includes a functional group or functional polymer group, said functional group or functional polymer group being a molecule that contains at least one of the following: water, an alcohol, an alkoxy, a ketone, an ester, an organosiloxane, an amine, a phosphine, an oxime, and substituted analogs thereof; 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.

Detailed Description

[0009] As discussed in International Publication No. WO 2012/091968, certain Lewis acids that may essentially require no activation time have been evaluated as polymerization catalysts. However, some Lewis acids may become deactivated rapidly and may not be capable of producing high molecular weight polymers or of obtaining high conversions of alkylene oxides to polymer. Further, high amounts of alkaline catalysts, such as sodium hydroxide may require treatment such as filtration and/or acid finishing/neutralization (e.g., as discussed in U.S. Patent No. 5,468,839) to reduce the base content of the resultant product. The use of a sufficiently low amount of Lewis acid catalysts and optionally a DMC catalyst may eliminate the need for such treatment, while also providing for control and/or selectivity. However, certain Lewis acid may promote undesirable side reactions. The presence of certain side products in a polyol product may necessitate performing an additional finishing step on the resultant product.

[0010] Embodiments relate to certain Lewis acid catalysts, and processes using such Lewis acid catalysts, that may provide advantages with respect to minimizing side reactions such as those that produce aldehydes and/or acetals, while still allowing for precise control of the polymerization reaction. Embodiments may relate to providing polyol polymers having a desirably low level of aldehydes and acetals. The polyols are derived from at least one alkylene oxide selected from propylene oxide and butylene oxide and may optionally essentially exclude intended addition of ethylene oxide. By Lewis acid it is meant a

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, R^1 , R^2 and R^3 each 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, and optional R^4 includes a functional group or functional polymer group, said functional group or functional polymer group being a molecule that contains at least one of the following: water, an alcohol, an alkoxy, a ketone, an ester, an organosiloxane, an amine, a phosphine, an oxime, and substituted analogs thereof; 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. 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 $M(R^1)_1(R^2)_1(R^3)_1(R^4)_1$, 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 R^4 includes a functional group or functional polymer group, said functional group or functional polymer group being a molecule that contains at least one of the following: water, an alcohol, an alkoxy, a ketone, an ester, an organosiloxane, an amine, a phosphine, an oxime, and substituted analogs thereof; 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.

3. The method as claimed in claim 2, wherein the Lewis acid catalyst has the general formula $M(R^1)_1(R^2)_1(R^3)_1(R^4)_1$, 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.

4. The method as claimed in claim 2, wherein R^4 is a cyclic ether having 3-10 carbon atoms.

5. The method as claimed in claim 2, wherein R^4 is a ketone having 3-10 carbon atoms.

6. The method as claimed in any one of claims 1 to 5, 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.

7. The method as claimed in any one of claims 1 to 6, 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.

8. 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 7, and
providing an isocyanate.