amounts of dialkyl-zinc, and exhibits addition of only one of the two alkyl groups from the zinc to the aldehyde. Accordingly, a need exists for a practical process for producing functional polymers or polyolefins that is adaptable for existing solution processes for commercial applications.

SUMMARY

[0004] In certain embodiments, the present disclosure relates to a one-pot process for synthesizing functional polymers by reacting an aldehyde with an alkyl-zinc or polymeryl-zinc composition in the presence of an effective promoter for the reaction. In certain embodiments, the present disclosure relates to a one-pot process for synthesizing functional polymers by reacting an aldehyde with an alkyl-zinc or polymeryl-zinc composition in the presence of a Lewis acid promoter. In certain embodiments, the present disclosure relates to a one-pot process for synthesizing functional polymers by reacting an aldehyde with an alkyl-zinc or polymeryl-zinc composition in the presence of a Lewis acid promoter, wherein the reaction is rapid and facile at high temperatures.

[0005] In further embodiments, the present disclosure relates to a one-pot process for synthesizing functional polymers by reacting an aldehyde with a polymeryl-zinc composition in the presence of a Lewis acid promoter, wherein the polymeryl-zinc composition is a polymer composition formed by a polymerization process. In further embodiments, the present disclosure relates to a one-pot process for synthesizing functional polymers by reacting an aldehyde with a polymeryl-zinc composition in the presence of a Lewis acid promoter, wherein the polymeryl-zinc composition is a polymer composition formed by a polymerization process, the polymerization process comprising: contacting at least one addition polymerizable monomer with a catalyst composition under polymerization conditions, the catalyst composition comprising the contact product of at least one catalyst precursor, at least one co-catalyst, and at least one chain shuttling agent.

[0005a] In one aspect, there is provided a process for producing a functional polymer comprising:

reacting an aldehyde with a zinc composition in the presence of a Lewis acid having the formula $(R_2N)_nMX_{4-n}$, wherein

the zinc composition has the formula ZnR'_2 or $R^1Zn[R'Zn—]_YR^1$, and wherein:

n is an integer from 1 to 3;

X is Cl, Br, or I;

R is a C_{1-10} hydrocarbon;

M is a Group 4 metal;

R' in each occurrence is an alkyl group or a polymer composition;

R^1 in each occurrence is independently selected from a polymer composition, alkyl, hydrogen, halide, amide, hydrocarbyl, hydrocarbylamide, dihydrocarbylamide, hydrocarbyloxide, hydrocarbylsulfide, dihydrocarbylphosphido, tri(hydrocarbyl)silyl; any hydrocarbyl group being optionally substituted with at least one halide, amide, hydrocarbylamide, dihydrocarbylamide, or hydrocarbyloxide; and each carbon-containing R^1 having from 1 to 50 carbon atoms, inclusive;

Y, on average, in each occurrence is a number from 1-150, inclusive; and wherein the Lewis acid is bis(dimethylamido)dichlorotitanium.

BRIEF DESCRIPTION OF THE DRAWINGS

What is claimed is:

1. A process for producing a functional polymer comprising:

reacting an aldehyde with a zinc composition in the presence of a Lewis acid having the formula $(R_2N)_nMX_{4-n}$, wherein

the zinc composition has the formula ZnR'_2 or $R^1Zn[R'Zn—]_YR^1$, and wherein:

n is an integer from 1 to 3;

X is Cl, Br, or I;

R is a C_{1-10} hydrocarbon;

M is a Group 4 metal;

R' in each occurrence is an alkyl group or a polymer composition;

R^1 in each occurrence is independently selected from a polymer composition, alkyl, hydrogen, halide, amide, hydrocarbyl, hydrocarbylamide, dihydrocarbylamide, hydrocarbyloxide, hydrocarbylsulfide, dihydrocarbylphosphido, tri(hydrocarbyl)silyl; any hydrocarbyl group being optionally substituted with at least one halide, amide, hydrocarbylamide, dihydrocarbylamide, or hydrocarbyloxide; and each carbon-containing R^1 having from 1 to 50 carbon atoms, inclusive;

Y, on average, in each occurrence is a number from 1-150, inclusive; and wherein the Lewis acid is bis(dimethylamido)dichlorotitanium.

2. The process of claim 1, wherein the polymer composition is formed by a polymerization process, the polymerization process comprising: contacting at least one addition polymerizable monomer with a catalyst composition under polymerization conditions, the catalyst composition comprising the contact product of at least one catalyst precursor, at least one co-catalyst, and at least one chain shuttling agent.

3. The process of claim 2, wherein the zinc composition has the formula $R^1Zn[R'Zn—]_YR^1$ and the at least one chain shuttling agent is a multi- or dual-headed chain shuttling agent.

4. The process of claim 1, wherein the reacting step is conducted at a temperature greater than 70°C.

5. The process of claim 1, wherein the reacting step is completed in less than 40 minutes.

6. The process of claim 1, wherein the functional polymer includes at least one amino group.

7. The process of claim 1, wherein the aldehyde includes at least one functional group.

8. The process of claim 7, wherein the at least one functional group is a vinyl, allyloxy, or styryl group.

9. The process of claim 8, wherein the functional polymer includes at least one amino group and a further functional group, wherein the further functional group is a vinyl, allyloxy, or styryl group.

10. The process of claim 1, wherein the zinc composition has the formula ZnR'_2, and wherein both R' groups of ZnR'_2 are reacted in the reacting step.

11. The process of claim 3, wherein the functional polymer is a telechelic polymer.