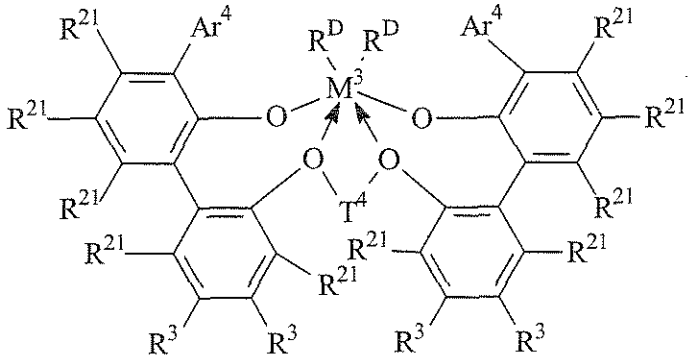
Summary ~~Of The Invention~~

T~~A first aspect of t~~he ~~invention~~disclosure provides a procatalyst carrier system comprising one or more paraffinic solvents, one or more paraffin-insoluble procatalysts, and optionally one or more cocatalysts wherein the carrier system is in the form of a slurry.

In a first aspect, the instant disclosure provides a procatalyst carrier system comprising one or more paraffinic solvents, one or more paraffin-insoluble procatalysts, and optionally one or more cocatalysts wherein the carrier system is in the form of a slurry; wherein the paraffin-insoluble procatalysts are not supported on inorganic materials and wherein the one or more paraffin-insoluble procatalysts are selected from the group of compounds according to the following formula:



wherein M^3 is Ti, Hf or Zr, preferably Zr; Ar^4 independently each occurrence is a substituted C_{9-20} aryl group, wherein the substituents, independently each occurrence, are selected from the group consisting of alkyl; cycloalkyl; and aryl groups; and halo-, trihydrocarbylsilyl- and halohydrocarbyl- substituted derivatives thereof, with the proviso that at least one substituent lacks co-planarity with the aryl group to which it is attached; T^4 independently each occurrence is a C_{2-20} alkylene, cycloalkylene or cycloalkenylene group, or an inertly substituted derivative thereof; R^{21} independently each occurrence is hydrogen, halo, hydrocarbyl, trihydrocarbylsilyl, trihydrocarbylsilylhydrocarbyl, alkoxy or di(hydrocarbyl)amino group of up to 50 atoms not counting hydrogen; R^3 independently each occurrence is hydrogen, halo, hydrocarbyl, trihydrocarbylsilyl, trihydrocarbylsilylhydrocarbyl, alkoxy or amino of up to 50 atoms not counting hydrogen, or two R^3 groups on the same arylene ring together or an R^3 and an R^{21} group on the same or different arylene ring together form a divalent ligand group attached to the arylene group in two positions or join two different arylene rings together; and R^D, independently each occurrence is halo or a hydrocarbyl or trihydrocarbylsilyl group of up to 20 atoms not

counting hydrogen, or 2 R^D groups together are a hydrocarbylene, hydrocarbadiyl, diene, or poly(hydrocarbyl)silylene group.

TAnother aspect of the inventiondisclosure provides a process comprising: selecting one or more paraffin-insoluble organometallic procatalysts; adding the one or more procatalysts to a sufficient quantity of paraffinic solvent to form a slurry of the one or more procatalysts in the paraffinic solvent; optionally, introducing one or more first cocatalysts into the polymerization reactor; and introducing the slurry into a polymerization reactor.

In a second aspect, the instant disclosure provides a process comprising:

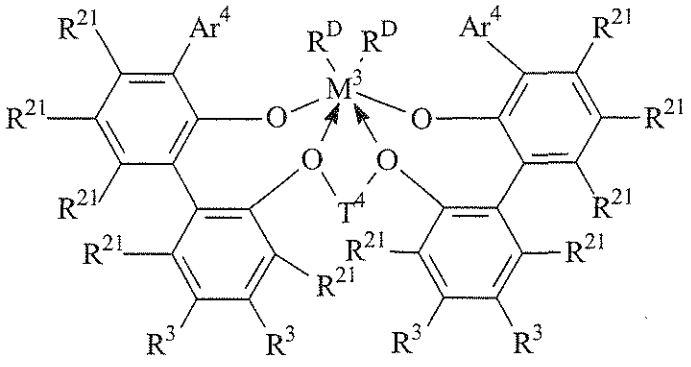
selecting one or more paraffin-insoluble organometallic procatalysts;

adding the one or more procatalysts to a sufficient quantity of paraffinic solvent to form a slurry of the one or more procatalysts in the paraffinic solvent;

introducing one or more first cocatalysts into a polymerization reactor; and

introducing the slurry into the polymerization reactor;

wherein the paraffin-insoluble procatalysts are not supported on inorganic materials and wherein the one or more paraffin-insoluble procatalyst is selected from the group of compounds according to the following formula:

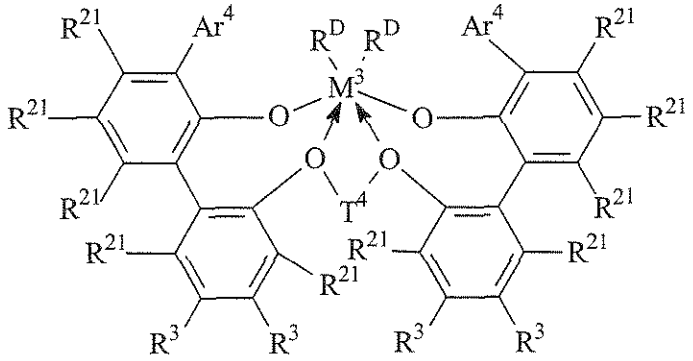


wherein M^3 is Ti, Hf or Zr, preferably Zr; Ar^4 independently each occurrence is a substituted C_{9-20} aryl group, wherein the substituents, independently each occurrence, are selected from the group consisting of alkyl; cycloalkyl; and aryl groups; and halo-, trihydrocarbylsilyl- and halohydrocarbyl- substituted derivatives thereof, with the proviso that at least one substituent lacks co-planarity with the aryl group to which it is attached; T^4 independently each occurrence is a C_{2-20} alkylene, cycloalkylene or cycloalkenylene group, or an inertly substituted derivative thereof; R^{21} independently each occurrence is hydrogen, halo, hydrocarbyl, trihydrocarbylsilyl, trihydrocarbylsilylhydrocarbyl, alkoxy or di(hydrocarbyl)amino group of up to 50 atoms not

counting hydrogen; R^3 independently each occurrence is hydrogen, halo, hydrocarbyl, trihydrocarbylsilyl, trihydrocarbylsilylhydrocarbyl, alkoxy or amino of up to 50 atoms not counting hydrogen, or two R^3 groups on the same arylene ring together or an R^3 and an R^{21} group on the same or different arylene ring together form a divalent ligand group attached to the arylene group in two positions or join two different arylene rings together; and R^D, independently each occurrence is halo or a hydrocarbyl or trihydrocarbylsilyl group of up to 20 atoms not counting hydrogen, or 2 R^D groups together are a hydrocarbylene, hydrocarbadiyl, diene, or poly(hydrocarbyl)silylene group.

In an alternative embodiment, the instant ~~invention~~disclosure provides a procatalyst carrier system and method of producing the same, except that, the one or more paraffin-insoluble procatalysts are selected from the group of transition metal organometallic compounds which catalyze the polymerization of olefins in the presence of a cocatalyst; biphenylphenol complexes of titanium, zirconium or hafnium; pyridylamine complexes of titanium, zirconium or hafnium; metallocene complexes of titanium, zirconium or hafnium; imine and phenolimine complexes of titanium, zirconium or hafnium; and combinations thereof.

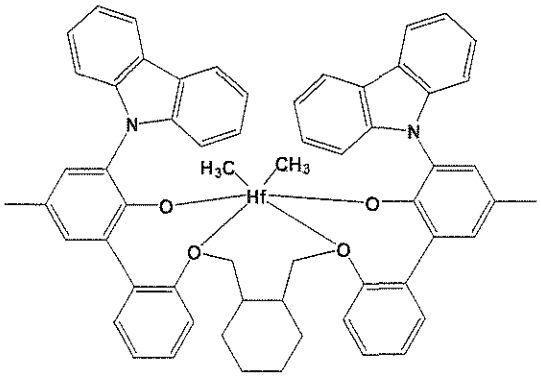
In an alternative embodiment, the instant ~~invention~~disclosure provides a procatalyst carrier system and method of producing the same, except that, the one or more paraffin-insoluble procatalysts are selected from the group of compounds according to the following formula:



wherein M^3 is Ti, Hf or Zr, preferably Zr; Ar^4 independently each occurrence is a substituted C_{9-20} aryl group, wherein the substituents, independently each occurrence, are selected from the group consisting of alkyl; cycloalkyl; and aryl groups; and halo-, trihydrocarbylsilyl- and halohydrocarbyl- substituted derivatives thereof, with the proviso that at least one substituent lacks co-planarity with the aryl group to which it is attached; T^4

independently each occurrence is a C_{2-20} alkylene, cycloalkylene or cycloalkenylene group, or an inertly substituted derivative thereof; R^{21} independently each occurrence is hydrogen, halo, hydrocarbyl, trihydrocarbylsilyl, trihydrocarbylsilylhydrocarbyl, alkoxy or di(hydrocarbyl)amino group of up to 50 atoms not counting hydrogen; R^3 independently each occurrence is hydrogen, halo, hydrocarbyl, trihydrocarbylsilyl, trihydrocarbylsilylhydrocarbyl, alkoxy or amino of up to 50 atoms not counting hydrogen, or two R^3 groups on the same arylene ring together or an R^3 and an R^{21} group on the same or different arylene ring together form a divalent ligand group attached to the arylene group in two positions or join two different arylene rings together; and R^D, independently each occurrence is halo or a hydrocarbyl or trihydrocarbylsilyl group of up to 20 atoms not counting hydrogen, or 2 R^D groups together are a hydrocarbylene, hydrocarbadiyl, diene, or poly(hydrocarbyl)silylene group.

In an alternative embodiment, the instant ~~invention~~disclosure provides a procatalyst carrier system and method of producing the same, except that, the one or more paraffin-insoluble procatalysts are selected from the group of



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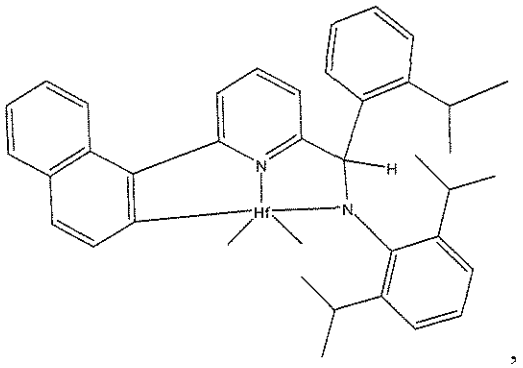

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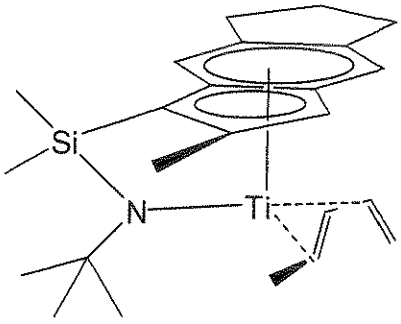

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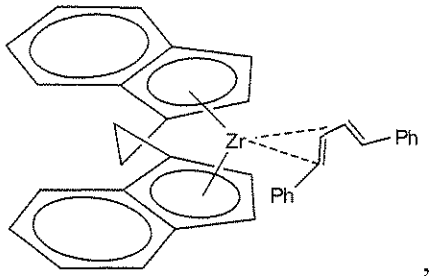

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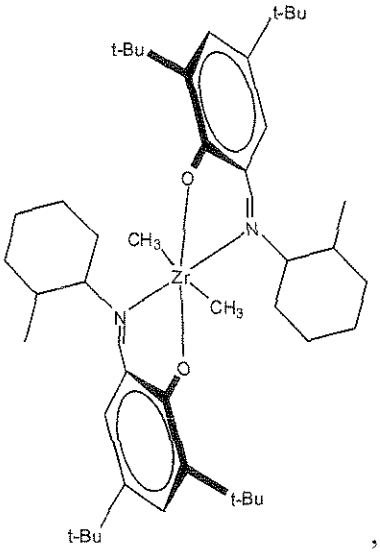

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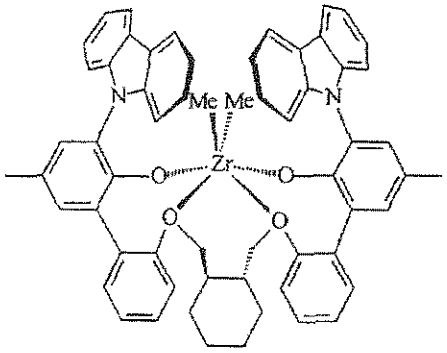

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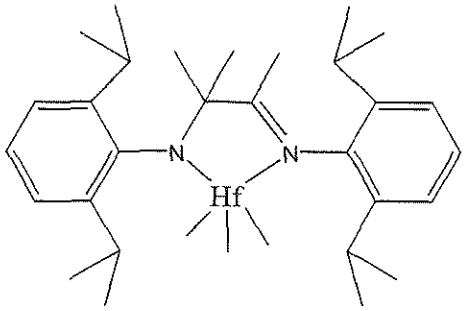
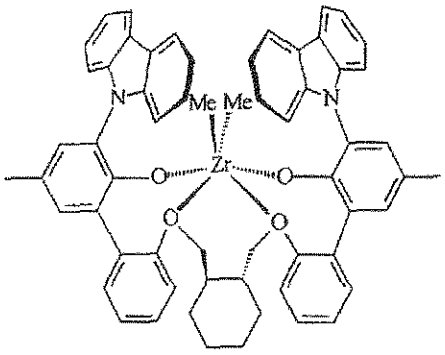


and .

In yet another embodiment of the ~~inventive~~disclosed procatalyst carrier system, the one or more paraffin-insoluble procatalysts comprises the compound depicted by:



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In an alternative embodiment, the instant ~~invention~~disclosure provides a procatalyst carrier system and method of producing the same, except that, the one or more cocatalysts are selected from the from group of modified methyl, isobutyl aluminoxane (MMAO) and bis(hydrogenated tallowalkyl)methylammonium tetrakis(pentafluorophenyl)borate.

In an alternative embodiment, the instant ~~invention~~disclosure provides a procatalyst carrier system and method of producing the same, except that, the ~~inventive~~disclosed procatalyst carrier system further comprises one or more scavengers.

In an alternative embodiment, the instant ~~invention~~disclosure provides a procatalyst carrier system and method of producing the same, except that, the one or more organometallic procatalysts are selected from the group of transition metal organometallic compounds which catalyze the polymerization of olefins in the presence of a cocatalyst; biphenylphenol complexes of titanium, zirconium or hafnium; pyridylamine complexes of titanium, zirconium or hafnium; metallocene complexes of titanium, zirconium or hafnium; imine and phenolimine complexes of titanium, zirconium or hafnium; and combinations thereof.

In an alternative embodiment, the instant ~~invention~~disclosure provides a procatalyst carrier system and method of producing the same, except that, the paraffinic solvent is selected from the group of normal alkanes, iso-alkanes, and combinations thereof which are liquids at the temperatures and pressures of a procatalyst preparation and delivery system.

In an alternative embodiment, the instant ~~invention~~disclosure provides a procatalyst carrier system and method of producing the same, except that, the ~~inventive~~disclosed process further comprises introducing one or more second cocatalysts into the procatalyst slurry prior to introducing the slurry into the polymerization reactor.

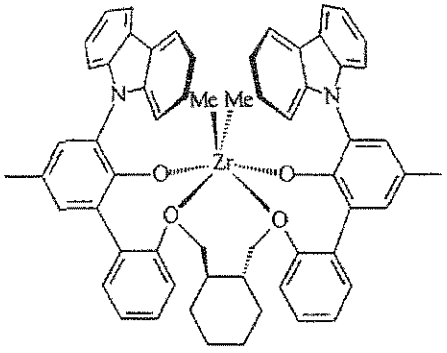
In an alternative embodiment, the instant ~~invention~~disclosure provides a procatalyst carrier system and method of producing the same, except that, the ~~inventive~~disclosed process further comprises introducing one or more first monomers selected from ethylene and propylene.

In an alternative embodiment, the instant ~~invention~~disclosure provides a procatalyst carrier system and method of producing the same, except that, the ~~inventive~~disclosed process further comprises introducing one or more C_3 to C_{20} α-olefins into the polymerization reactor.

In an alternative embodiment, the instant ~~invention~~disclosure provides a procatalyst carrier system and method of producing the same, except that, the ~~inventive~~disclosed process further comprises introducing one or more dienes into the polymerization reactor.

In an alternative embodiment, the instant ~~invention~~disclosure provides a procatalyst carrier system and method of producing the same, except that, the one or more first monomers is ethylene, the one or more C_3 to C_{20} α-olefins is propylene, and the one or more dienes is ethylidenenorborene.

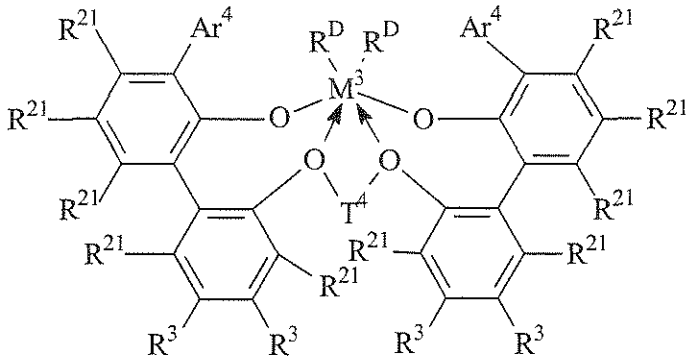
In an alternative embodiment, the instant ~~invention~~disclosure provides a procatalyst carrier system and method of producing the same, except that, the one or more paraffin-insoluble procatalysts comprises the compound depicted by:



In an alternative embodiment, the instant ~~invention~~disclosure provides a procatalyst carrier system and method of producing the same, except that, the one or more first cocatalysts and one or more second cocatalysts are selected from the from group of MMAO and bis(hydrogenated tallowalkyl)methylammonium tetrakis(pentafluorophenyl)borate.

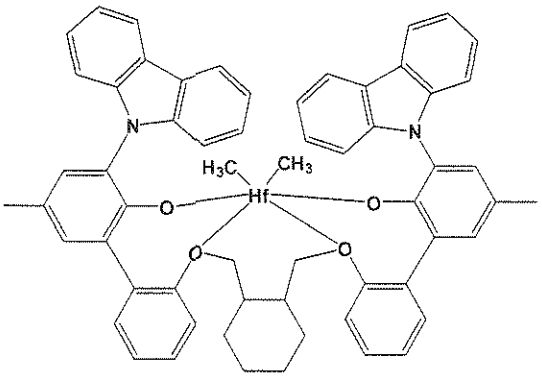
In an alternative embodiment, the instant ~~invention~~disclosure provides a procatalyst carrier system and method of producing the same, except that, the polymerization reactor is a solution reactor.

In an alternative embodiment, the instant ~~invention~~disclosure provides a procatalyst carrier system and method of producing the same, except that, the one or more paraffin-insoluble procatalyst is selected from the group of compounds according to the following formula:



wherein M^3 is Ti, Hf or Zr, preferably Zr; Ar^4 independently each occurrence is a substituted C_{9-20} aryl group, wherein the substituents, independently each occurrence, are selected from the group consisting of alkyl; cycloalkyl; and aryl groups; and halo-, trihydrocarbylsilyl- and halohydrocarbyl- substituted derivatives thereof, with the proviso that at least one substituent lacks co-planarity with the aryl group to which it is attached; T^4 independently each occurrence is a C_{2-20} alkylene, cycloalkylene or cycloalkenylene group, or an inertly substituted derivative thereof; R^{21} independently each occurrence is hydrogen, halo, hydrocarbyl, trihydrocarbylsilyl, trihydrocarbylsilylhydrocarbyl, alkoxy or di(hydrocarbyl)amino group of up to 50 atoms not counting hydrogen; R^3 independently each occurrence is hydrogen, halo, hydrocarbyl, trihydrocarbylsilyl, trihydrocarbylsilylhydrocarbyl, alkoxy or amino of up to 50 atoms not counting hydrogen, or two R^3 groups on the same arylene ring together or an R^3 and an R^{21} group on the same or different arylene ring together form a divalent ligand group attached to the arylene group in two positions or join two different arylene rings together; and R^D, independently each occurrence is halo or a hydrocarbyl or trihydrocarbylsilyl group of up to 20 atoms not counting hydrogen, or 2 R^D groups together are a hydrocarbylene, hydrocarbadiyl, diene, or poly(hydrocarbyl)silylene group.

In an alternative embodiment, the instant ~~invention~~disclosure provides a procatalyst carrier system and method of producing the same, except that, the one or more paraffin-insoluble organometallic procatalysts is selected from the group of



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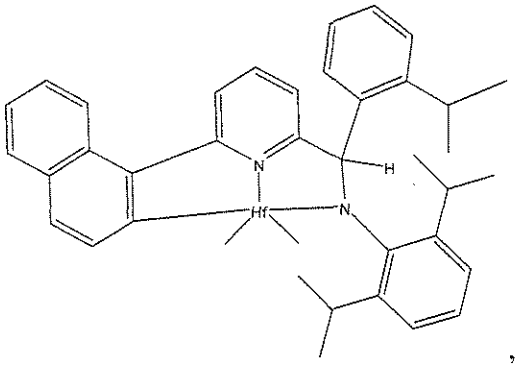

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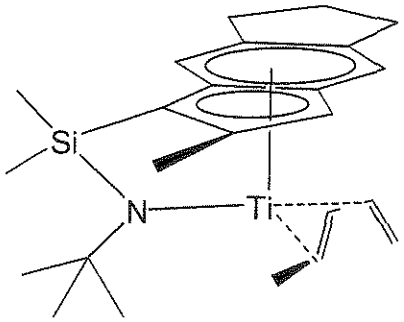

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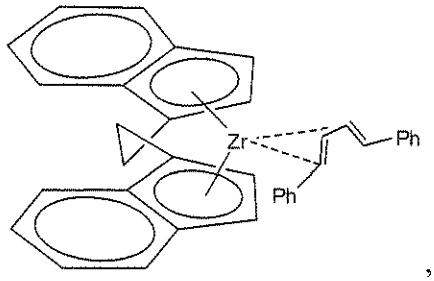

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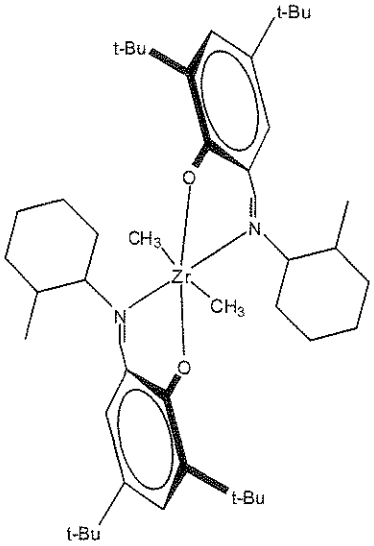

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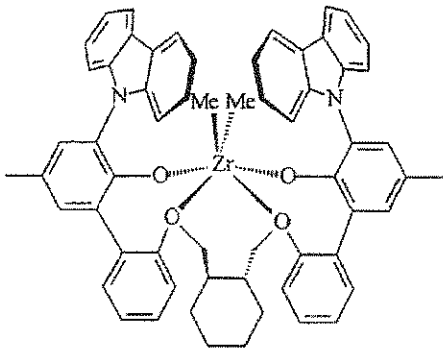

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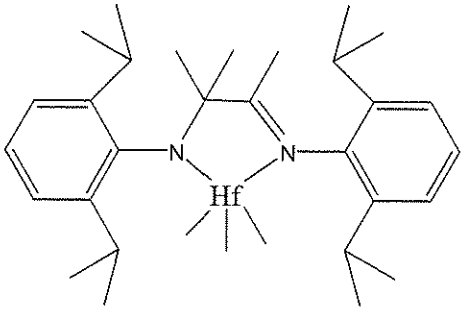

and .

Yet another embodiment of the ~~invention~~disclosure provides a reaction product of any one or any combination of the foregoing embodiments of the ~~inventive~~disclosed process. In certain specific embodiments the reaction product is an EPDM.

Yet another embodiment of the ~~invention~~disclosure provides an article produced from any one or any combination of two or more of the foregoing embodiments of the ~~inventive~~disclosed reaction products of the ~~inventive~~disclosed process.

Yet another embodiment of the ~~invention~~disclosure provides a procatalyst carrier system consisting essentially of one or more paraffinic solvents, one or more paraffin-insoluble procatalysts, and optionally one or more cocatalysts wherein the carrier system is in the form of a slurry.

Yet another aspect of the ~~invention~~disclosure provides a process consisting essentially of: selecting one or more paraffin-insoluble organometallic procatalysts; adding the one or more procatalysts to a sufficient quantity of paraffinic solvent to form a slurry of the one or more procatalysts in the paraffinic solvent; optionally, introducing one or more first cocatalysts into the polymerization reactor; optionally introducing one or more scavengers into the polymerization reactor; introducing the slurry into a polymerization reactor; introducing one or more olefin monomers into the polymerization reactor; and recovering one or more products from the polymerization reactor.

Brief Description Of The Figures

For the purpose of illustrating the invention, there is shown in the drawings a form that is exemplary; it being understood, however, that this invention is not limited to the precise arrangements and instrumentalities shown.

Fig. 1 depicts the GPC-RI chromatograms of the LLDPE polymers made in Inventive Example 1 and Comparative Example 2;

Fig. 2 depicts the GPC-RI chromatograms of the EPDM polymers made in Inventive Example 2 and Comparative Example 2; and

Fig. 3 depicts the viscosity of EPDM polymers made in Inventive Example 2 and Comparative Example 2.

Detailed Description

The term "paraffin-insoluble" in reference to a compound means that the compound forms a solution in a paraffinic solvent at levels of 0.005 wt % or less compound based on the weight of the paraffinic solvent at temperatures and pressures extant in a procatalyst slurry preparation and delivery system.

The term "paraffinic solvent" means a solvent comprising normal and/or branched alkanes wherein the paraffinic solvent contains less than 100 ppm by weight total aromatic