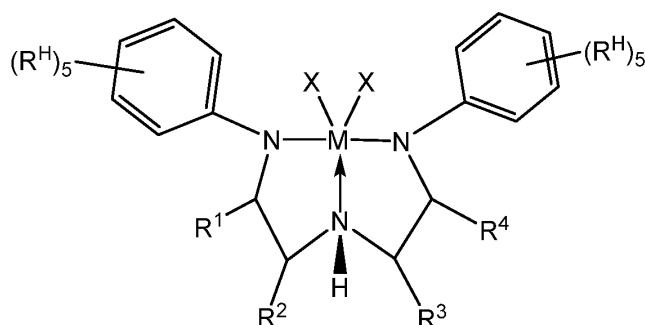


CLAIMS

1. A method of making an attenuated post-metallocene catalyst ("attenuated-light-off post-metallocene catalyst"), the method comprising combining a faster-light-off catalyst with an effective amount of a kinetics modifier compound ("KMC") of formula (A¹), (B¹), or (C¹): R⁵-C≡C-R⁶ (A¹), (R⁵)₂C=C=C(R⁶)₂ (B¹), or (R⁵)(R⁷)C=C(R⁶)(R⁷) (C¹) under effective reaction conditions to give an attenuated-light-off post-metallocene catalyst that exhibits an attenuated light-off monomer uptake profile; wherein the faster-light-off catalyst has been made by activating a post-metallocene precatalyst of structural formula (I):

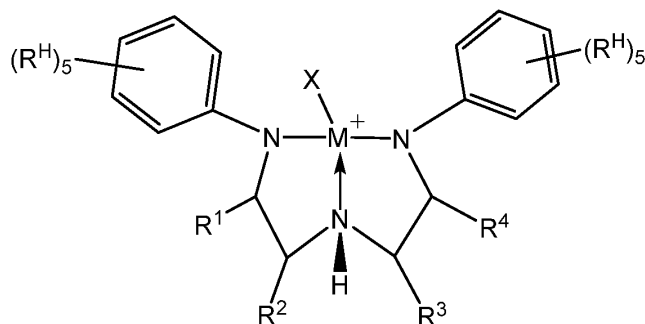


(I); wherein in formula (A¹), (B¹),

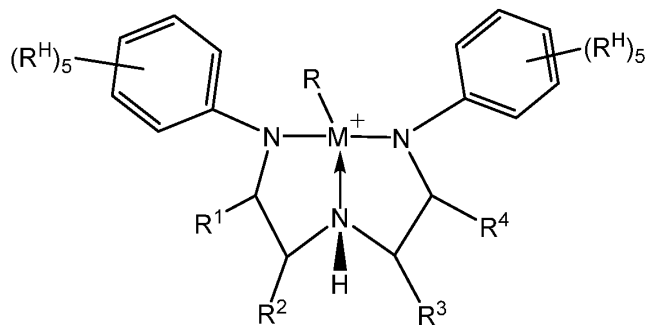
or (C¹) each of R⁵ and R⁶ independently is H or R⁷; and each R⁷ independently is a (C₁-C₂₀)hydrocarbyl, -C(=O)-O-(unsubstituted C₁-C₂₀)hydrocarbyl, a (C₁-C₁₉)heterohydrocarbyl, or a tri((C₁-C₂₀)hydrocarbyl)silyl, or two R⁷ are taken together to form a (C₃-C₆)alkylene; with the proviso that each R⁷ lacks a carbon-carbon double bond; wherein each (C₁-C₂₀)hydrocarbyl independently is unsubstituted or substituted with from 1 to 4 substituent groups R^S; wherein each substituent group R^S is independently selected from halogen, unsubstituted (C₁-C₅)alkyl, -C≡CH, -OH, (C₁-C₅)alkoxy, -C(=O)-(unsubstituted (C₁-C₅)alkyl), -NH₂, -N(H)(unsubstituted (C₁-C₅)alkyl), -N(unsubstituted (C₁-C₅)alkyl)₂, -COOH, -C(=O)-NH₂, -C(=O)-N(H)(unsubstituted (C₁-C₅)alkyl), -C(=O)-N(unsubstituted (C₁-C₅)alkyl)₂, -S(unsubstituted (C₁-C₅)alkyl), -S(=O)₂(unsubstituted (C₁-C₅)alkyl), -S(=O)₂-NH₂, -S(=O)₂-N(H)(unsubstituted (C₁-C₅)alkyl), -S(=O)₂-N(unsubstituted (C₁-C₅)alkyl)₂, -C(=)S(unsubstituted (C₁-C₅)alkyl) and -COO(unsubstituted (C₁-C₅)alkyl); and wherein M is Ti, Zr, or Hf; each of R¹ to R⁴ independently is H or CH₃; each R^H independently is a (C₁-C₂₀)alkyl; and X is independently a monodentate group independently selected from a halogen atom, ((C₁-C₂₀)alkyl)_{3-g}-(phenyl)_gSi- wherein subscript g is 0, 1, 2, or 3; CH₃, a (C₂-C₂₀)alkyl-CH₂, a (C₆-C₁₂)aryl-((C₀-C₁₀)alkylene)-CH₂, a (C₁-C₆)alkyl-substituted (C₆-C₁₂)aryl, a (C₁-C₆)alkoxy-substituted (C₆-C₁₂)aryl, a (C₁-C₆)alkoxy-

substituted benzyl, and a (C₁-C₆)alkyl-substituted benzyl; or one X is a 4-(C₁-C₂₀)alkyl-substituted 1,3-butadiene molecule and each of the remaining X, if any, independently is the monodentate group X; with the proviso that at least one X is a (C₇-C₂₀)aralkyl.

2. The method of claim 1 wherein the faster-light-off catalyst is of formula (II):



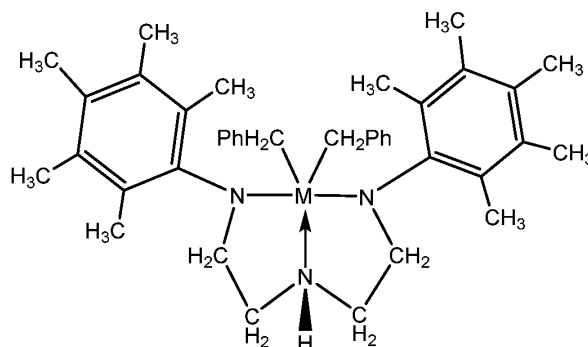
attenuated post-metallocene catalyst is of formula (II):



A⁻ (III); wherein each of groups

R¹ to R⁴ and R^H and X are as defined for formula (I); wherein A⁻ is an anion (used to formally balance the positive charge of metal M); and wherein R is a ligand of formula (A), (B), or (C): -C(R⁵)=C(X)R⁶ (A), -C(R⁵)₂-C(X)=C(R⁶)₂ (B), or -C(R⁵)(R⁷)-C(X)(R⁶)(R⁷) (C), respectively; and wherein R⁵ to R⁷ are as defined previously for formula (A¹), (B¹), or (C¹) respectively.

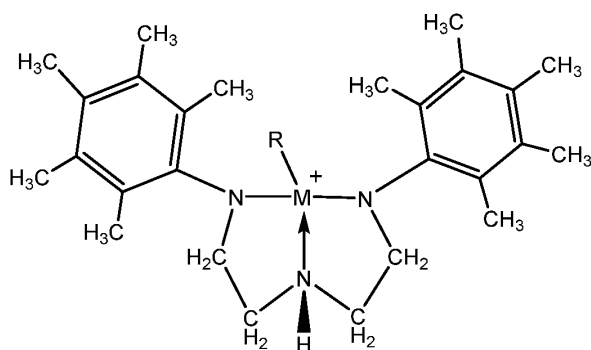
3. The method of claim 1 or 2 wherein in the post-metallocene precatalyst of formula (I), each of R¹ to R⁴ is H and each X is benzyl and the post-metallocene precatalyst of formula



(I) is precatalyst (1):
Hf or Zr.

(1), wherein M is

4. The method of any one of claims 1 to 3 wherein in the post-metallocene precatalyst of formula (I), each of R^1 to R^4 is H and each R^H is CH_3 , and the attenuated post-metallocene catalyst is of formula (III) is attenuated light-off catalyst (1):



A^- (III-a); wherein A^- is an anion

(used to formally balance the positive charge of metal M); and wherein R is a ligand of formula (A), (B), or (C): $-C(R^5)=C(X)R^6$ (A), $-C(R^5)_2-C(X)=C(R^6)_2$ (B), or $-C(R^5)(R^7)-C(X)(R^6)(R^7)$ (C), respectively; and wherein R^5 to R^7 are as defined previously for formula (A¹), (B¹), or (C¹) respectively. M is Hf or Zr.

5. The method of any one of claims 1 to 4 wherein the kinetics modifier compound is described by any one of limitations (i) to (vi): (i) of formula (A¹) or (B¹), (ii) of formula (A¹) or (C¹), (iii) of formula (B¹) or (C¹), (iv) of formula (A¹), (v) of formula (B¹), or (vi) of formula (C¹).

6. The method of any one of claims 1 to 5 wherein the kinetics modifier compound is of formula (A¹): $R^5-C\equiv C-R^6$ (A¹) that is selected from phenylacetylene; a (substituted-phenyl)acetylene; diphenylacetylene; a substituted diphenylacetylene; a cycloalkylacetylene; an acetylene of formula $HC\equiv C-Si(phenyl)_h((C_1-C_{20})alkyl)_{3-h}$, wherein subscript h is an integer from 0 to 3; and an acetylene of formula $HC\equiv C-(CH_2)_mCH_3$, wherein subscript m is an integer from 1 to 15.

7. The method of any one of claim 1 to 5 wherein the kinetics modifier compound is of formula (B¹): (R⁵)₂C=C=C(R⁶)₂ (B¹) and is selected from a cycloalkylallene; an alkylallene; a dialkylallene; a trialkylallene; a trialkylsilyllallene; a vinylidenecycloalkane; and an alkyl ester of an allenecarboxylic acid.
8. The method of any one of claims 1 to 5 wherein the kinetics modifier compound is of formula (C¹): (R⁵)(R⁷)C=C(R⁶)(R⁷) (C¹) and the kinetics modifier compound of formula (C¹) is an internal alkene.
9. The method of any one of claims 1 to 8 further comprising, before the combining step, a step of making the faster-light-off catalyst by activating the precatalyst of formula (I) with the activator under effective activating conditions, thereby making the faster-light-off catalyst.
10. The method of any one of claims 1 to 9 wherein the method further comprises making a mixture of the attenuated post-metallocene catalyst, a support material, and an inert hydrocarbon solvent and removing the inert hydrocarbon solvent from the mixture so as to give the attenuated post-metallocene catalyst disposed on the support material.
11. An attenuated post-metallocene catalyst made by the method of any one of claims 1 to 10.
12. A method of feeding a post-metallocene catalyst to a slurry-phase or gas-phase polymerization reactor containing an olefin monomer and a moving bed of polyolefin polymer, the method comprising making the attenuated post-metallocene catalyst outside of the reactor and according to the method of any one of claims 1 to 10, and feeding the attenuated post-metallocene catalyst in neat form or as a solution or slurry thereof in an inert hydrocarbon liquid through a feed line free of olefin monomer into the slurry-phase or gas-phase polymerization reactor.
13. A multimodal catalyst system comprising the attenuated post-metallocene catalyst of claim 11 and at least one second catalyst selected from the group consisting of an unattenuated post-metallocene catalyst described herein, a different attenuated post-metallocene catalyst, and a metallocene catalyst.
14. A method of making a polyolefin polymer, the method comprising contacting at least one 1-alkene monomer with the attenuated post-metallocene catalyst made by the method of any one of claims 1 to 10, or the multimodal catalyst system of claim 14, under slurry-phase or gas-phase polymerization conditions in a slurry-phase or gas-phase polymerization reactor containing a moving bed of polyolefin resin, thereby making the polyolefin polymer.