Claims

1. Catalyst composition for the oligomerization of ethylene, comprising

   (i) an at least partially hydrolyzed transition metal compound, obtainable by controlled addition of water to a transition metal compound having the general formula $MX_m(OR')_{4-m}$ or $MX_m(OOCR')_{4-m}$, wherein R' is an alkyl, alkenyl, aryl, aralkyl or cycloalkyl group, X is halogen, preferably Cl or Br, and m is from 0 to 4, preferably 0-3; and

   (ii) an organoaluminum compound as a cocatalyst,

   wherein the molar ratio of water and transition metal compound is within a range of between about (0.01-3):1.

2. Catalyst composition according to claim 1, wherein the molar ratio of water and the transition metal compound is within a range of about (0.1-2):1.

3. Catalyst composition according to claim 1 or 2, wherein the transition metal compound is a zirconium compound.

4. Catalyst composition according to claim 3, wherein the zirconium compound is a zirconium carboxylate having the formula $(R^2COO)_mZrCl_{4-m}$, wherein R^2 is an alkyl, alkenyl, aryl, aralkyl or cycloalkyl group, and m is any number within the range of from 0 to 4.

5. Catalyst composition according to any of the preceding claims, wherein the organoaluminum compound has the general formula $R^1_nAlZ_{3-n}$ or $Al_2Z_3R^1_3$, wherein R^1

represents an alkyl group having from 1 to 20 carbon atoms, Z represents Cl, Br or I, n is any number within the range $1 \leq n \leq 2$.

6. Catalyst composition according to claim 5, wherein the organoaluminum compound is $Al(C_2H_5)_3$, $Al_2Cl_3(C_2H_5)_3$, $AlCl(C_2H_5)_2$ or mixtures thereof.

7. Catalyst composition according to any of the preceding claims, wherein the molar ratio of the organoaluminum compound and the transition metal compound is within a range of from 1:1 to 40:1.

8. Catalyst composition according to any of the preceding claims, wherein the transition metal compound is partially hydrolyzed.

9. Process for preparing linear alpha-olefins by oligomerization of ethylene in the presence of an organic solvent and a catalyst composition, wherein the cataylst composition is anyone according to any of the preceding claims.

10. Method for preparing a catalyst composition according to any of the preceding claims 1 to 8, comprising the steps of:

    (i) controlled addition of water to the transition metal compound, wherein the transition metal compound is provided in solution; and

    (ii) combining the organoaluminum compound with the solution of the at least partially hydrolyzed transition metal compound.

11. Method according to claim 10, wherein the water in step (i) is added incrementally, preferably dropwise, in a staged or sequenced manner, as water vapor or is added by release from water-containing solids.

12. Method according to claim 10 or 11, wherein during and/or after addition of water the solution is agitated for 1 minute to 60 minutes, preferably 1 minute to about 30 minutes, preferably at ambient temperature.

Claims

1. Catalyst composition for the oligomerization of ethylene, comprising

   (i) an at least partially hydrolyzed transition metal compound, obtained by controlled addition of water to a transition metal compound having the general formula $MX_m(OOCR')_{4-m}$, wherein R' is an alkyl, alkenyl, aryl, aralkyl or cycloalkyl group, X is halogen, and m is from 0 to 4; and

   (ii) an organoaluminum compound as a cocatalyst,

   wherein the molar ratio of water and transition metal compound is within a range of between about (0.01-3):1.

2. Catalyst composition according to claim 1, wherein the halogen is Cl or Br.

3. Catalyst composition according to claim 1 or 2, wherein m is from 0 to 3.

4. Catalyst composition according to any one of claims 1 to 3, wherein the molar ratio of water and the transition metal compound is within a range of about (0.1-2):1.

5. Catalyst composition according to any one of claims 1 to 4, wherein the transition metal compound is a zirconium compound.

6. Catalyst composition according to claim 5, wherein the zirconium compound is a zirconium carboxylate having the formula $(R^2COO)_pZrCl_{4-p}$, wherein R^2 is an alkyl, alkenyl, aryl, aralkyl or cycloalkyl group, and p is any number within the range of from 1 to 4.

7. Catalyst composition according to claim 1, wherein the organoaluminum compound has the general formula $R^1_nAlZ_{3-n}$ or $Al_2Z_3R^1_3$, wherein R^1 represents an alkyl group having from 1 to 20 carbon atoms, Z represents Cl, Br or I, n is any number within the range $1 \leq n \leq 2$.

8. Catalyst composition according to claim 1, wherein the organoaluminum compound is $Al(C_2H_5)_3$, $Al_2Cl_3(C_2H_5)_3$, $AlCl(C_2H_5)_2$ or mixtures thereof.

9. Catalyst composition according to claim 1, wherein the molar ratio of the organoaluminum compound and the transition metal compound is within a range of from 1:1 to 40:1.

10. Catalyst composition according to claim 1, wherein the transition metal compound is partially hydrolyzed.

11. Process for preparing linear alpha-olefins by oligomerization of ethylene in the presence of an organic solvent and a catalyst composition, wherein the catalyst composition is according to any one of claims 1 to 10.

12. Method for preparing a catalyst composition according to any one of claims 1 to 10, comprising the steps of:

    (i) controlled addition of water to the transition metal compound, wherein the transition metal compound is provided in solution; and

    (ii) combining the organoaluminum compound with the solution of the at least partially hydrolyzed transition metal compound.

13. Method according to claim 12, wherein the water in step (i) is added incrementally, in a staged or sequenced manner, as water vapor or is added by release from water-containing solids.

14. Method according to claim 13, wherein the water is added dropwise.

15. Method according to claim 12, wherein the solution is agitated for 1 minute to 60 minutes: during addition of water; after addition of water; or a combination thereof.

16. Method according to claim 15, wherein the solution is agitated for 1 minute to about 30 minutes at ambient temperature.