Claims

1. A magnesium halide solution,

consisting of a magnesium halide, an oxygen-containing organic titanium compound, a hydroxyl-containing compound, an organic solvent; and an organic heterocyclic compound;

wherein the organic solvent is selected from the group consisting of a hydrocarbon and a halogenated hydrocarbon.

2. The magnesium halide solution according to claim 1, wherein the organic heterocyclic compound is at least one selected from the group consisting of a sulphur-containing organic heterocyclic compound, a nitrogen-containing organic heterocyclic compound, and an organic epoxy compound.

3. The magnesium halide solution according to claim 2, wherein the sulphur-containing organic heterocyclic compound is at least one selected from the group consisting of a 3 to 8-membered ring sulphur-containing heterocyclic compound and a sulphur-containing heterocyclic compound that is in parallel connection with a benzene ring to form a condensed ring.

4. The magnesium halide solution according to claim 2, wherein the nitrogen-containing organic heterocyclic compound is at least one selected from the group consisting of a 3 to 8-membered ring nitrogen-containing heterocyclic compound and a nitrogen-containing heterocyclic compound that is in parallel connection with a benzene ring to form a condensed ring.

5. The magnesium halide solution according to claim 2, wherein the organic epoxy compound is a 3 to 8-membered epoxy compound.

6. The magnesium halide solution according to claim 2, wherein the organic epoxy compound is at least one selected from the group consisting of ethylene oxide, propylene oxide, butylene oxide, butadiene oxide, butadiene double oxide,

epichlorohydrin, methyl glycidyl ether, diglycidyl ether, and tetrahydrofuran.

7. The magnesium halide solution according to claim 1, wherein the magnesium halide solution is formed by dissolving an anhydrous magnesium halide into a mixed solvent that is composed of the oxygen-containing organic titanium compound, the organic heterocyclic compound, the hydroxyl-containing compound, and the organic solvent.

8. The magnesium halide solution according to claim 1, wherein a molar concentration of magnesium halide in the magnesium halide solution ranges from 0.0001 mol/L to 20 mol/L.

9. The magnesium halide solution according to claim 1, wherein measuring by 1 mol of magnesium halide, the magnesium halide solution contains the oxygen-containing organic titanium compound 0.01 mol to 2.0 mol, the organic heterocyclic compound 0.01 mol to 10 mol, and the hydroxyl-containing compound 0.01 mol to 20 mol.

10. The magnesium halide solution according to claim 1,

wherein a formula of the magnesium halide is MgX_2, X being halogen; and

wherein a formula of the oxygen-containing organic titanium compound is $Ti(OR^3)_nX_{4-n}$, R^3 representing C_1 to C_{20} saturated or unsaturated linear, branched, or cyclic hydrocarbyl, $0<n\leq4$, and X being halogen.

11. The magnesium halide solution according to claim 1,

wherein a formula of the hydroxyl-containing compound is HOR^4, R^4 representing C_1 to C_{20} saturated or unsaturated linear, branched, or cyclic hydrocarbyl;

wherein the hydrocarbon is C_3 to C_{100} saturated or unsaturated linear, branched, or cyclic aliphatic hydrocarbon or aromatic hydrocarbon and

wherein the halogenated hydrocarbon is C_3 to C_{100} saturated or unsaturated linear, branched, or cyclic aliphatic halogenated hydrocarbon or aromatic halogenated hydrocarbon.

12. The magnesium halide solution according to claim 1,

wherein the magnesium halide is at least one selected from the group consisting of magnesium chloride, magnesium bromide, and magnesium iodide;

wherein the oxygen-containing organic titanium compound is a titanate compound;

wherein the hydroxyl-containing compound is at least one selected from the group consisting of aliphatic alcohols, aromatic alcohols, and phenols;

wherein the hydrocarbon is at least one selected from the group consisting of benzene, toluene, xylene, n-butane, isobutene, isopentane, n-pentane, n-hexane, cyclohexane, heptanes, octane, and decane; and

wherein the halogenated hydrocarbon is selected from 1, 2-dichloroethane and~~/or~~ chlorobenzene.

13. A method for preparing the magnesium halide solution according to claim 1, comprising dissolving an anhydrous magnesium halide into a mixed solvent that is composed of an oxygen-containing organic titanium compound, an organic heterocyclic compound, a hydroxyl-containing compound, and an organic solvent until the obtained mixture is uniform.

14. The method according to claim 13, comprising mixing the anhydrous magnesium halide with the oxygen-containing organic titanium compound, the organic heterocyclic compound, and the hydroxyl-containing compound until the obtained mixture is uniform, and then mixing a solution obtained therein with the organic solvent so as to obtain the magnesium halide solution.

15. The method according to claim 13 or 14,

wherein a mixing temperature ranges from 0 ^{o}C to 200 ^{o}C; and

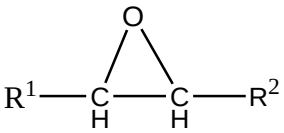
wherein a mixing time ranges from 10 minutes to 24 hours.

16. The magnesium halide solution according to claim 2, wherein the sulphur-containing organic heterocyclic compound is at least one selected from the

group consisting of thiophene, thiazole, isothiazole, benzothiophene, and 4,6-dimethylbenzothiophene.

17. The magnesium halide solution according to claim 2, wherein the nitrogen-containing organic heterocyclic compound is at least one selected from the group consisting of pyrrole, thiazole, imidazole, pyridine, pyrazine, pyrimidine, pyridazine, indole, quinoline, and pteridine.

18. The magnesium halide solution according to claim 2, wherein the organic epoxy compound is a 3-membered epoxy compound as shown in formula (I):



(I)

wherein in formula (I), R^1 and R^2 respectively represent H, or C_1 to C_{10} saturated or unsaturated linear, branched, or cyclic hydrocarbyl or halogenated hydrocarbyl.

19. The magnesium halide solution according to claim 8, wherein a molar concentration of magnesium halide in the magnesium halide solution ranges from 0.001 mol/L to 10 mol/L.

20. The magnesium halide solution according to claim 19, wherein a molar concentration of magnesium halide in the magnesium halide solution ranges from 0.1 mol/L to 10 mol/L.

21. The magnesium halide solution according to claim 9, wherein measuring by 1 mol of magnesium halide, the magnesium halide solution contains the oxygen-containing organic titanium compound 0.1 mol to 1.5 mol, the organic heterocyclic compound 0.1 mol to 6.5 mol, and the hydroxyl-containing compound 0.1 mol to 15 mol.

22. The magnesium halide solution according to claim 11, wherein the hydrocarbon is C_4 to C_{20} hydrocarbon; and the halogenated hydrocarbon is C_4 to C_{20}

halogenated hydrocarbon.

23. The magnesium halide solution according to claim 12, wherein the oxygen-containing organic titanium compound is at least one selected from the group consisting of tetraethyl titanate, tetraisopropyl titanate, tetrabutyl titanate, and tetraisooctyl titanate;

wherein the hydroxyl-containing compound is at least one selected from the group consisting of methanol, ethanol, isopropanol, n-butanol, n-hexanol, isooctanol, benzyl alcohol, and phenylethyl alcohol.

24. The method according to claim 15, wherein the mixing temperature ranges from 20 °C to 150 °C; and the mixing time ranges from 2 hours to 16 hours.

25. An olefin polymerization process, comprising preparing a catalyst by the magnesium halide solution according to claim 1, and then using the obtained catalyst in olefin polymerization reaction;

wherein the preparing a catalyst comprises mixing the magnesium halide solution with a halogen compound to obtain solid particles, washing and drying the solid particles to obtain the catalyst;

wherein the using the obtained catalyst in olefin polymerization reaction comprises polymerization of olefin that is performed in the presence of the obtained catalyst.

26. The process according to claim 25, wherein the magnesium halide solution is used for preparing an olefin polymerization reaction catalyst.