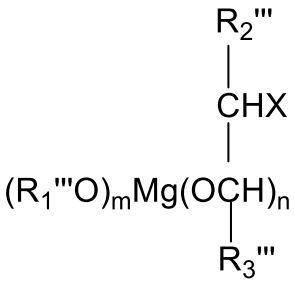
**Claims**

1. A catalyst component for olefin polymerization, comprising magnesium, titanium, a halogen, and an internal electron donor, wherein the internal electron donor comprises a monocarboxylic ester compound and a diether compound, a molar ratio of the monocarboxylic ester compound to the diether compound being (0.0035-0.7):1,

wherein the catalyst component is a product produced from a reaction of a magnesium source comprising sulfur, a titanium source, and the internal electron donor;

wherein the magnesium source comprises a magnesium compound of Formula IV,



Formula IV

wherein in Formula IV,

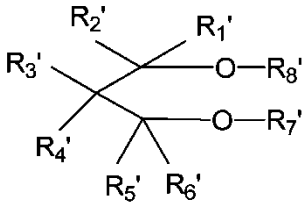
$R_1'''$ is selected from the group consisting of substituted or unsubstituted $C_1$-$C_{10}$ linear alkyl, substituted or unsubstituted $C_3$-$C_{10}$ branched alkyl, substituted or unsubstituted $C_3$-$C_{10}$ cycloalkyl, substituted or unsubstituted $C_6$-$C_{20}$ aryl, substituted or unsubstituted $C_7$-$C_{20}$ aralkyl, and substituted or unsubstituted $C_7$-$C_{20}$ alkaryl,

$R_2'''$ and $R_3'''$ are identical to or different, each independently selected from the group consisting of hydrogen, substituted or unsubstituted $C_1$-$C_{10}$ linear alkyl, substituted or unsubstituted $C_3$-$C_{10}$ branched alkyl, substituted or unsubstituted $C_3$-$C_{10}$ cycloalkyl, substituted or unsubstituted $C_6$-$C_{20}$ aryl, substituted or unsubstituted $C_7$-$C_{20}$ aralkyl, and substituted or unsubstituted $C_7$-$C_{20}$ alkaryl, and

X is a halogen, m is 0.1-1.9, n is 0.1-1.9, and m+n=2.

2. The catalyst component according to claim 1, wherein the molar ratio of the monocarboxylic ester compound to the diether compound is (0.01-0.35):1.

3. The catalyst component according to claim 1, wherein the diether compound is a diether compound of Formula I,




Formula I

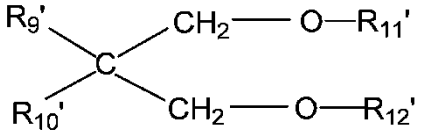
wherein in Formula I,

$R_1'$, $R_2'$, $R_3'$, $R_4'$, $R_5'$ and $R_6'$ are identical to or different, each independently selected from the group consisting of hydrogen, halogen, substituted or unsubstituted $C_1$-$C_{20}$ linear or branched alkyl, substituted or unsubstituted $C_3$-$C_{20}$ cycloalkyl, substituted or unsubstituted $C_6$-$C_{20}$ aryl, substituted or unsubstituted $C_7$-$C_{20}$ aralkyl, and substituted or unsubstituted $C_7$-$C_{20}$ alkaryl; or, two or more of $R_1'$, $R_2'$, $R_3'$, $R_4'$, $R_5'$ and $R_6'$ are connected to form a ring;

$R_7'$ and $R_8'$ are identical to or different, each independently selected from the group consisting of substituted or unsubstituted $C_1$-$C_{20}$ linear or branched alkyl, substituted or unsubstituted $C_3$-$C_{20}$ cycloalkyl, substituted or unsubstituted $C_6$-$C_{20}$ aryl, substituted or unsubstituted $C_7$-$C_{20}$ aralkyl, and substituted or unsubstituted $C_7$-$C_{20}$ alkaryl; and

the monocarboxylic ester compound is selected from an aromatic monocarboxylic ester and an aliphatic monocarboxylic ester.

4. The catalyst component according to claim 1, wherein the diether compound is a 1,3-diether compound of Formula II,




Formula II

wherein in Formula II,

$R_9'$ and $R_{10}'$ are identical to or different, each independently selected from the group consisting of hydrogen, halogen, substituted or unsubstituted $C_1$-$C_{18}$ linear or branched alkyl, substituted or unsubstituted $C_3$-$C_{18}$ cycloalkyl, substituted or unsubstituted $C_6$-$C_{18}$ aryl, substituted or unsubstituted $C_7$-$C_{18}$ aralkyl, and substituted or unsubstituted $C_7$-$C_{18}$ alkaryl; or, $R_9'$ and $R_{10}'$ are connected to form a ring; and

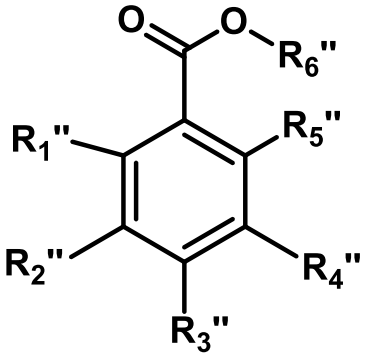
$R_{11}'$ and $R_{12}'$ are identical to or different, each independently being substituted or unsubstituted $C_1$-$C_{10}$ linear or branched alkyl.

5. The catalyst component according to claim 3, wherein the aliphatic monocarboxylic ester is a monoester formed by an aliphatic monocarboxylic acid having 2-10 carbon atoms

and an aliphatic mono- or polyhydric alcohol having 1-15 carbon atoms or an aromatic alcohol having 6-15 carbon atoms; and

the aromatic monocarboxylic ester is a monoester formed by an aromatic monocarboxylic acid having 7-10 carbon atoms and an aliphatic mono- or polyhydric alcohol having 1-15 carbon atoms or an aromatic alcohol having 6-15 carbon atoms.

6. The catalyst component according to claim 1, wherein the aromatic monocarboxylic ester is an aromatic monocarboxylic ester of Formula III:




Formula III

wherein in Formula III,

$R_1$", $R_2$", $R_3$", $R_4$", and $R_5$" are identical to or different, each independently selected from the group consisting of hydrogen, hydroxyl, halogen, amino, substituted or unsubstituted $C_1$-$C_{10}$ linear or branched alkyl, substituted or unsubstituted $C_1$-$C_{10}$ alkoxy, substituted or unsubstituted $C_3$-$C_{10}$ cycloalkyl, substituted or unsubstituted $C_6$-$C_{10}$ aryl, substituted or unsubstituted $C_7$-$C_{10}$ aralkyl, and substituted or unsubstituted $C_7$-$C_{10}$ alkaryl; or any two of $R_1$", $R_2$", $R_3$", $R_4$", and $R_5$" are connected to form an aromatic ring or an aliphatic ring; and

$R_6$" is selected from the group consisting of substituted or unsubstituted $C_1$-$C_{10}$ linear or branched alkyl, substituted or unsubstituted $C_3$-$C_{10}$ cycloalkyl, substituted or unsubstituted $C_6$-$C_{10}$ aryl, substituted or unsubstituted $C_7$-$C_{10}$ aralkyl, and substituted or unsubstituted $C_7$-$C_{10}$ alkaryl.

7. The catalyst component according to claim 1,

wherein in Formula IV,

$R_1$"' is selected from the group consisting of substituted or unsubstituted $C_1$-$C_8$ linear alkyl, substituted or unsubstituted $C_3$-$C_8$ branched alkyl, substituted or unsubstituted $C_3$-$C_8$ cycloalkyl, substituted or unsubstituted $C_6$-$C_{15}$ aryl, substituted or unsubstituted $C_7$-$C_{15}$ aralkyl, and substituted or unsubstituted $C_7$-$C_{15}$ alkaryl;

$R_2$"' and $R_3$"' are each independently selected from the group consisting of hydrogen,

substituted or unsubstituted $C_1$-$C_{10}$ linear alkyl, substituted or unsubstituted $C_3$-$C_8$ branched alkyl, substituted or unsubstituted $C_3$-$C_8$ cycloalkyl, substituted or unsubstituted $C_6$-$C_{10}$ aryl, substituted or unsubstituted $C_7$-$C_{10}$ aralkyl, and substituted or unsubstituted $C_7$-$C_{10}$ alkaryl;

X is chlorine or bromine;

the titanium source is selected from the group consisting of titanium halide, titanium alkoxide halide, and titanium alkoxide.

8. The catalyst component according to claim 1, wherein a molar ratio of sulfur to magnesium in the magnesium source is q:1, wherein $0<q\leqq 0.5$.

9. The catalyst component according to claim 1, wherein the magnesium source is prepared by a method comprising the following steps:

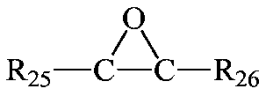
(1) preparing a mixture, wherein the mixture comprises elemental sulfur, a magnesium halide represented by a general formula $MgX_1Y$, a compound represented by a general formula $R_1OH$, an optional inert liquid medium, and an optional surfactant; and

(2) subjecting the mixture obtained in step (1) to a contact reaction with an ethylene oxide compound;

wherein in the general formula $MgX_1Y$, $X_1$ is a halogen; and Y is selected from the group consisting of halogen, substituted or unsubstituted $C_1$-$C_{10}$ linear alkyl, substituted or unsubstituted $C_3$-$C_{10}$ branched alkyl, substituted or unsubstituted $C_3$-$C_{10}$ cycloalkyl, substituted or unsubstituted $C_6$-$C_{20}$ aryl, substituted or unsubstituted $C_1$-$C_{10}$ alkoxy, substituted or unsubstituted $C_6$-$C_{20}$ aryloxy, substituted or unsubstituted $C_7$-$C_{20}$ aralkyl, and substituted or unsubstituted $C_7$-$C_{20}$ alkaryl;

in the general formula $R_1OH$, $R_1$ is selected from the group consisting of substituted or unsubstituted $C_1$-$C_{10}$ linear alkyl, substituted or unsubstituted $C_3$-$C_{10}$ branched alkyl, substituted or unsubstituted $C_3$-$C_{10}$ cycloalkyl, substituted or unsubstituted $C_6$-$C_{20}$ aryl, substituted or unsubstituted $C_7$-$C_{20}$ aralkyl, and substituted or unsubstituted $C_7$-$C_{20}$ alkaryl; and

the ethylene oxide compound is of Formula V:



Formula V

wherein in Formula V, $R_{25}$ and $R_{26}$ are each independently selected from the group

consisting of hydrogen, substituted or unsubstituted $C_1$-$C_{10}$ linear alkyl, substituted or unsubstituted $C_3$-$C_{10}$ branched alkyl, substituted or unsubstituted $C_3$-$C_{10}$ cycloalkyl, substituted or unsubstituted $C_6$-$C_{20}$ aryl, substituted or unsubstituted $C_7$-$C_{20}$ aralkyl, and substituted or unsubstituted $C_7$-$C_{20}$ alkaryl.

10. The catalyst component according to claim 9, wherein based on 1 mol of the magnesium halide represented by the general formula $MgX_1Y$, the elemental sulfur is present in an amount of 0.0001-0.5 mol, the compound represented by the general formula $R_1OH$ is present in an amount of 4-30 mol, and the ethylene oxide compound is present in an amount of 1-10 mol.

11. The catalyst component according to claim 9, wherein in step (1), the heating is conducted at a temperature of 80-120°C for a time period of 0.5-5 hours; and

in step (2), the contact reaction is carried out at a temperature of 40-120°C for a time period of 15-60 minutes.

12. The catalyst component according to claim 9, wherein the inert liquid medium is a silicone oil solvent and/or a hydrocarbon solvent; and/or

based on 1 mol of the magnesium halide represented by the general formula $MgX_1Y$, the inert liquid medium is present in an amount of 0.8-10 L.

13. The catalyst component according to claim 9, wherein the surfactant is at least one selected from the group consisting of polyvinylpyrrolidone, polyethylene glycol, polyvinyl alcohol, polyacrylic acid, polyacrylate, polyacrylamide, polystyrene sulfonate, naphthalenesulfonic acid formaldehyde condensate, condensed alkyl phenyl ether sulfate, condensed alkyl phenol polyoxyethylene ether phosphate, oxyalkyl acrylate copolymer modified polyethyleneimine, 1-dodeca-4-vinylpyridine bromide polymer, polyvinylbenzyltrimethylamine salt, polyethylene oxide propylene oxide block copolymer, polyvinylpyrrolidone vinyl acetate copolymer, alkyl phenyl polyoxyethylene ether, and polyalkyl methacrylate; and/or

based on 1 mol of the magnesium halide represented by the general formula $MgX_1Y$, the surfactant is present in an amount of 1-20 g.

14. The catalyst component according to claim 9, wherein in the general formula $MgX_1Y$,

$X_1$ is chlorine or bromine, and Y is chlorine, bromine, $C_1$-$C_5$ alkoxy or $C_6$-$C_{10}$ aryloxy; and/or

in the general formula $R_1OH$, $R_1$ is $C_1$-$C_8$ alkyl; and/or

in the ethylene oxide compound of Formula V, $R_{25}$ and $R_{26}$ are each independently hydrogen, $C_1$-$C_3$ alkyl, or $C_1$-$C_3$ halogenated alkyl.

15. The catalyst component according to claim 1, wherein in the catalyst component, a weight ratio of titanium as titanium element, to magnesium as magnesium element, to the halogen, and to the internal electron donor is 1:2-15:8-30:2-15.

16. A catalyst for olefin polymerization, comprising:

(1) the catalyst component according to claim 1;

(2) at least one alkyl aluminum compound; and

(3) an optional external electron donor compound.

17. An olefin polymerization method, comprising: contacting the olefin with an catalyst according to claim 16 under olefin polymerization condition, wherein, the olefin comprises at least one of olefin of formula $CH_2$=CHR, R being hydrogen, $C_1$-$C_6$ linear alkyl, or $C_1$-$C_6$ branched alkyl.

18. The catalyst component according to claim 3, wherein in Formula I,

$R_1$', $R_2$', $R_3$', $R_4$', $R_5$' and $R_6$' are identical to or different, each independently selected from the group consisting of hydrogen, halogen, substituted or unsubstituted $C_1$-$C_{18}$ linear or branched alkyl, substituted or unsubstituted $C_3$-$C_{18}$ cycloalkyl, substituted or unsubstituted $C_6$-$C_{18}$ aryl, substituted or unsubstituted $C_7$-$C_{18}$ aralkyl, and substituted or unsubstituted $C_7$-$C_{18}$ alkaryl; or, two or more of $R_1$', $R_2$', $R_3$', $R_4$', $R_5$', and $R_6$' are connected to form a ring;

$R_7$' and $R_8$' are identical to or different, each independently selected from the group consisting of substituted or unsubstituted $C_1$-$C_{10}$ linear or branched alkyl, substituted or unsubstituted $C_3$-$C_{10}$ cycloalkyl, substituted or unsubstituted $C_6$-$C_{15}$ aryl, substituted or unsubstituted $C_7$-$C_{15}$ aralkyl, and substituted or unsubstituted $C_7$-$C_{15}$ alkaryl.

19. The catalyst component according to claim 4, wherein in Formula II,

$R_9$' and $R_{10}$' are identical to or different, each independently selected from the group

consisting of hydrogen, halogen, substituted or unsubstituted $C_1$-$C_{10}$ linear or branched alkyl, substituted or unsubstituted $C_3$-$C_{10}$ cycloalkyl, substituted or unsubstituted $C_6$-$C_{15}$ aryl, substituted or unsubstituted $C_7$-$C_{15}$ aralkyl, and substituted or unsubstituted $C_7$-$C_{15}$ alkaryl; or, $R_9$' and $R_{10}$' are connected to form a fluorene ring.

20. The catalyst component according to claim 7,

wherein in Formula IV,

$R_1$''' is selected from the group consisting of substituted or unsubstituted $C_1$-$C_6$ linear alkyl, substituted or unsubstituted $C_3$-$C_6$ branched alkyl, substituted or unsubstituted $C_3$-$C_6$ cycloalkyl, substituted or unsubstituted $C_6$-$C_{10}$ aryl, substituted or unsubstituted $C_7$-$C_{10}$ aralkyl, and substituted or unsubstituted $C_7$-$C_{10}$ alkaryl;

$R_2$''' and $R_3$''' are identical to or different, each independently selected from the group consisting of hydrogen, substituted or unsubstituted $C_1$-$C_6$ linear alkyl, substituted or unsubstituted $C_3$-$C_6$ branched alkyl, substituted or unsubstituted $C_3$-$C_6$ cycloalkyl, substituted or unsubstituted $C_6$-$C_8$ aryl, substituted or unsubstituted $C_7$-$C_9$ aralkyl, and substituted or unsubstituted $C_7$-$C_9$ alkylaryl; and

the titanium source comprises a compound represented by a general formula $Ti(OR')_{3-a}Z_a$ and/or $Ti(OR')_{4-b}Z_b$, wherein R' is $C_1$-$C_{20}$ alkyl; Z is F, Cl, Br or I; a is an integer from 1 to 3; and b is an integer from 1 to 4.

21. The catalyst component according to claim 9,

wherein in step (1), the mixture is obtained by mixing the elemental sulfur, the magnesium halide represented by the general formula $MgX_1Y$, the compound represented by the general formula $R_1OH$, the optional inert liquid medium, and the optional surfactant together and then heating a resulting mixture;

wherein in the general formula $MgX_1Y$, $X_1$ is chlorine or bromine;

wherein in the general formula $R_1OH$, $R_1$ is selected from the group consisting of substituted or unsubstituted $C_1$-$C_8$ linear alkyl, substituted or unsubstituted $C_3$-$C_8$ branched alkyl, substituted or unsubstituted $C_3$-$C_8$ cycloalkyl, substituted or unsubstituted $C_6$-$C_{15}$ aryl, substituted or unsubstituted $C_7$-$C_{15}$ aralkyl, and substituted or unsubstituted $C_7$-$C_{15}$ alkaryl;

wherein in Formula V, $R_{25}$ and $R_{26}$ are each independently selected from the group consisting of hydrogen, substituted or unsubstituted $C_1$-$C_8$ linear alkyl, substituted or unsubstituted $C_3$-$C_8$ branched alkyl, substituted or unsubstituted $C_3$-$C_8$ cycloalkyl, substituted or unsubstituted $C_6$-$C_{10}$ aryl, substituted or unsubstituted $C_7$-$C_{10}$ aralkyl, and substituted or unsubstituted $C_7$-$C_{10}$ alkaryl.

22. The catalyst component according to claim 9,

wherein in the general formula $R_1OH$, $R_1$ is selected from the group consisting of substituted or unsubstituted $C_1$-$C_6$ linear alkyl, substituted or unsubstituted $C_3$-$C_6$ branched alkyl, substituted or unsubstituted $C_3$-$C_6$ cycloalkyl, substituted or unsubstituted $C_6$-$C_{10}$ aryl, substituted or unsubstituted $C_7$-$C_{10}$ aralkyl, and substituted or unsubstituted $C_7$-$C_{10}$ alkaryl; and

wherein in Formula V, $R_{25}$ and $R_{26}$ are each independently selected from the group consisting of hydrogen, substituted or unsubstituted $C_1$-$C_6$ linear alkyl, substituted or unsubstituted $C_3$-$C_6$ branched alkyl, substituted or unsubstituted $C_3$-$C_6$ cycloalkyl, substituted or unsubstituted $C_6$-$C_8$ aryl, substituted or unsubstituted $C_7$-$C_9$ aralkyl, and substituted or unsubstituted $C_7$-$C_9$ alkylaryl.

23. The catalyst component according to claim 12, wherein the inert liquid medium is at least one selected from the group consisting of kerosene, paraffin oil, petrolatum oil, white oil, methyl silicone oil, ethyl silicone oil, methyl ethyl silicone oil, phenyl silicone oil, and methyl phenyl silicone oil.

24. The catalyst component according to claim 14, wherein the magnesium halide represented by the general formula $MgX_1Y$ is at least one selected from the group consisting of magnesium chloride, magnesium bromide, phenoxymagnesium chloride, isopropoxymagnesium chloride, and n-butoxymagnesium chloride; and/or

the compound represented by the general formula $R_1OH$ is at least one selected from the group consisting of ethanol, n-propanol, isopropanol, n-butanol, isobutanol, n-pentanol, isopentanol, n-hexanol, 2-ethylhexanol, and n-octanol; and/or

the ethylene oxide compound is at least one selected from the group consisting of ethylene oxide, epoxypropane, epoxybutane, epoxychloropropane, epoxychlorobutane, epoxybromopropane, and epoxybromobutane.