CLAIMS

1. A method for producing a propylene-based block copolymer comprising bringing an olefin polymerization catalyst into contact with propylene, or propylene and an α-olefin other than propylene, and bringing an electron donor compound (IV), which is an organic compound that includes an oxygen atom, into contact with the resulting product, the olefin polymerization catalyst comprising a solid catalyst component for olefin polymerization that comprises titanium, magnesium, a halogen, and an internal electron donor compound, an organoaluminum compound represented by a general formula (I), and an external electron donor compound represented by a general formula (II) or an external electron donor compound represented by a general formula (III),

$$R^1_pAlQ_{3-p} \qquad (I)$$

wherein R^1 is a hydrocarbyl group having 1 to 6 carbon atoms, p is a real number that satisfies $0<p\leq3$, provided that a plurality of R^1 are either identical to or different from each other when a plurality of R^1 are present, and Q is a hydrogen atom, a hydrocarbyloxy group having 1 to 6 carbon atoms, or a halogen atom, provided that a plurality of Q are either identical to or different from each other when a plurality of Q are present,

$$R^2Si(OR^3)_3 \qquad (II)$$

wherein R^2 is a hydrogen atom, a linear alkyl group having 1 to 20 carbon atoms, a branched alkyl group having 3 to 20 carbon atoms, a vinyl group, an allyl group, a linear or branched alkenyl group having 3 to 20 carbon atoms, a cycloalkyl group having 3 to 20 carbon atoms, a cycloalkenyl group having 3 to 20 carbon atoms, an aromatic hydrocarbon group having 6 to 24 carbon atoms, a nitrogen atom-containing hydrocarbon group having 2 to 24 carbon atoms that is terminated by a carbon atom, or an amino group having 2 to 24 carbon atoms, and R^3 is a linear alkyl

group having 1 to 20 carbon atoms, a branched alkyl group having 3 to 20 carbon atoms, a vinyl group, an allyl group, a linear or branched alkenyl group having 3 to 20 carbon atoms, a cycloalkyl group having 3 to 20 carbon atoms, a cycloalkenyl group having 3 to 20 carbon atoms, or an aromatic hydrocarbon group having 6 to 24 carbon atoms, provided that the three R^3 are either identical to or different from each other,

$$(R^4R^5N)Si(OR^6)_3 \qquad \text{(III)}$$

wherein R^4 and R^5 are a hydrogen atom, a linear alkyl group having 1 to 20 carbon atoms, a branched alkyl group having 3 to 20 carbon atoms, a vinyl group, an allyl group, a linear or branched alkenyl group having 3 to 20 carbon atoms, a cycloalkyl group having 3 to 20 carbon atoms, a cycloalkenyl group having 3 to 20 carbon atoms, an aromatic hydrocarbon group having 6 to 24 carbon atoms, a nitrogen atom-containing hydrocarbon group having 2 to 24 carbon atoms that is terminated by a carbon atom, or an amino group having 2 to 24 carbon atoms, provided that R^4 and R^5 are either identical to or different from each other, and are optionally bonded to each other to form a ring, and R^6 is a linear alkyl group having 1 to 20 carbon atoms, a branched alkyl group having 3 to 20 carbon atoms, a vinyl group, an allyl group, a linear or branched alkenyl group having 3 to 20 carbon atoms, a cycloalkyl group having 3 to 20 carbon atoms, a cycloalkenyl group having 3 to 20 carbon atoms, or an aromatic hydrocarbon group having 6 to 24 carbon atoms, provided that the three R^6 are either identical to or different from each other.

2. The method for producing a propylene-based block copolymer according to claim 1, wherein the electron donor compound (IV) is an alcohol.

3. The method for producing a propylene-based block copolymer according to claim 1 or 2, wherein the electron donor compound (IV) is methanol or ethanol.

4. The method for producing a propylene-based block copolymer according to any one of claims 1 to 3, wherein the external electron donor compound represented by the general formula (II) is an external electron donor compound represented by a general formula (IIa), or the external electron donor compound represented by the general formula (III) is an external electron donor compound represented by a general formula (IIIa),

$$R^7Si(OR^8)_3 \qquad \text{(IIa)}$$

wherein R^7 is a hydrogen atom, a linear alkyl group having 1 to 12 carbon atoms, a branched alkyl group having 3 to 12 carbon atoms, a vinyl group, an allyl group, a linear or branched alkenyl group having 3 to 12 carbon atoms, a cycloalkyl group having 3 to 12 carbon atoms, a cycloalkenyl group having 3 to 12 carbon atoms, an aromatic hydrocarbon group having 6 to 12 carbon atoms, a nitrogen atom-containing hydrocarbon group having 2 to 12 carbon atoms that is terminated by a carbon atom, or an amino group having 2 to 12 carbon atoms, and R^8 is a linear alkyl group having 1 to 12 carbon atoms, a branched alkyl group having 3 to 12 carbon atoms, a vinyl group, an allyl group, a linear or branched alkenyl group having 3 to 12 carbon atoms, a cycloalkyl group having 3 to 12 carbon atoms, a cycloalkenyl group having 3 to 12 carbon atoms, or an aromatic hydrocarbon group having 6 to 12 carbon atoms, provided that the three R^8 are either identical to or different from each other,

$$(R^9R^{10}N)Si(OR^{11})_3 \qquad \text{(IIIa)}$$

wherein R^9 and R^{10} are a hydrogen atom, a linear alkyl group having 1 to 12 carbon atoms, a branched alkyl group having 3 to 12 carbon atoms, a vinyl group, an allyl group, a linear or branched alkenyl group having 3 to 12 carbon atoms, a cycloalkyl group having 3 to 12 carbon atoms, a cycloalkenyl group having 3 to 12 carbon atoms, an aromatic hydrocarbon group having 6 to 12 carbon atoms, a nitrogen atom-containing hydrocarbon group having 2 to 12 carbon atoms that is terminated by a carbon atom, or an amino group having 2 to 12 carbon atoms, provided that R^9 and R^{10}

are either identical to or different from each other, and are optionally bonded to each other to form a ring, and R^{11} is a linear alkyl group having 1 to 12 carbon atoms, a branched alkyl group having 3 to 12 carbon atoms, a vinyl group, an allyl group, a linear or branched alkenyl group having 3 to 12 carbon atoms, a cycloalkyl group having 3 to 12 carbon atoms, a cycloalkenyl group having 3 to 12 carbon atoms, or an aromatic hydrocarbon group having 6 to 12 carbon atoms, provided that the three R^{11} are either identical to or different from each other.

5. The method for producing a propylene-based block copolymer according to any one of claims 1 to 3, wherein the external electron donor compound (II) is one or more compounds selected from isopropyltriethoxysilane, isopropyltrimethoxysilane, n-propyltriethoxysilane, n-propyltrimethoxysilane, methyltriethoxysilane, methyltrimethoxysilane, ethyltriethoxysilane, ethyltrimethoxysilane, n-butyltriethoxysilane, n-butyltrimethoxysilane, isobutyltriethoxysilane, isobutyltrimethoxysilane, t-butyltriethoxysilane, t-butyltrimethoxysilane, cyclopentyltriethoxysilane, cyclohexyltriethoxysilane, phenyltrimethoxysilane, and phenyltriethoxysilane.

6. The method for producing a propylene-based block copolymer according to any one of claims 1 to 3, wherein the external electron donor compound (III) is one or more compounds selected from diethylaminotriethoxysilane, diethylaminotrimethoxysilane, dimethylaminotriethoxysilane, and dimethylaminotrimethoxysilane.