【CLAIMS】

【Claim 1】 An apparatus for preparing polybutene comprising:

a complex catalyst preparation device for preparing a highly active complex catalyst and low-activity complex catalyst to form highly reactive polybutene through polymerization;

a high-molar ratio complex catalyst system for controlling storage and supply of the high-activity complex catalyst;

a low-molar ratio complex catalyst system for controlling storage and supply of the low-activity complex catalyst; and

a reactor to which the highly active complex catalyst, the low-activity complex catalyst, and a reaction raw material comprising isobutene are supplied to polymerize isobutene into a highly reactive polybutene.

【Claim 2】 The apparatus according to claim 1, further comprising an in-line mixer for mixing the highly active complex catalyst and the low-activity complex catalyst to form the highly reactive polybutene through polymerization.

【Claim 3】 The apparatus according to claim 1, wherein the complex catalyst used to form the highly reactive polybutene through polymerization comprises a highly active complex catalyst having a cocatalyst/main catalyst molar ratio is greater than or equal to 1 and less than 1.5, and a molar ratio of the low-activity complex catalyst the cocatalyst/main catalyst molar ratio is in a range of 1.5 to 3.

【Claim 4】 The apparatus according to claim 1, wherein the highly reactive polybutene has a vinylidene content of at least 70% at one end of a molecule thereof.

【Claim 5】 The apparatus according to claim 1, wherein the catalyst supplied through the complex catalyst preparation device comprises a main catalyst, a cocatalyst comprising water or an alcohol compound, and an auxiliary cocatalyst comprising an alkyl ether.

【Claim 6】 The apparatus according to claim 5, wherein the main catalyst is a Lewis acid selected from the group consisting of boron trifluoride, boron trichloride, aluminum trichloride, and zinc chloride.

【Claim 7】 The apparatus according to claim 6, wherein the boron trifluoride is fed so that a content of the boron trifluoride is in a range of 0.1 to 1.0 parts by weight, based on 100 parts by weight of the isobutene.

【Claim 8】 The apparatus according to claim 5, wherein the alcohol compound is selected from the group consisting of methanol, ethanol, propanol, isopropyl alcohol (isopropanol), butanol, and isobutanol, and the alkyl ether is selected from the group consisting of dimethyl ether, diethyl ether, dipropyl ether, isopropyl sec-butyl ether, sec-butyl ether, isoamyl ether, isopropyl isoamyl ether, and sec-butyl isoamyl ether.

【Claim 9】 A method of preparing polybutene, comprising:

preparing a highly active complex catalyst and a low-activity complex catalyst to form highly reactive polybutene through polymerization;

controlling storage and supply of the highly active complex catalyst and the low-activity complex catalyst; and

supplying the highly active complex catalyst, the low-activity complex catalyst, and a reaction raw material comprising isobutene to polymerize isobutene into a highly reactive polybutene.

【Claim 10】 The method according to claim 9, further comprising mixing the highly active complex catalyst and the low-activity complex catalyst to form the highly reactive polybutene through polymerization.

【Claim 11】 The method according to claim 9, wherein the highly reactive polybutene is polymerized at a temperature of -40 to 20°C and a pressure of 3 kg/cm^2 or more for a retention time of 5 to 100 minutes.

【Claim 12】 A highly reactive polybutene obtained by the method of preparing polybutene defined in claim 9.

【Claim 13】 An apparatus for preparing polybutene having an easily controllable molecular weight, comprising:

a complex catalyst preparation device for preparing a complex catalyst comprising an alcohol compound as a cocatalyst and boron trifluoride as a main catalyst;

a complex catalyst supply device for controlling supply of the complex catalyst transferred from the complex catalyst preparation device;

a raw material injection line for supplying a reaction raw material;

an auxiliary cocatalyst injection line for incorporating an ether compound as an auxiliary cocatalyst to the complex catalyst or the reaction raw material; and

a reactor for reacting the reaction raw material supplied from the raw material injection line with a mixture of the auxiliary cocatalyst and the complex catalyst or reacting the complex catalyst supplied from the complex catalyst supply device with a mixture of the auxiliary cocatalyst and the reaction raw material to polymerize isobutene into polybutene.

【Claim 14】 The apparatus according to claim 13, wherein the auxiliary cocatalyst controls reactivity of the complex catalyst and imparts steric hindrance.

【Claim 15】 The apparatus according to claim 13, wherein a molar ratio of the cocatalyst to the main catalyst is in a range of 1 to 2, and a molar ratio of the cocatalyst and the auxiliary cocatalyst to the main catalyst is in a range of 1.1 to 3.

【Claim 16】 The apparatus according to claim 13, wherein the polybutene is a highly reactive polybutene having a vinylidene content of at least 70% at one end of a molecule thereof.

【Claim 17】 The apparatus according to claim 13, wherein the boron trifluoride is present in an amount of 0.02 to 1 part by weight, based on 100 parts by weight of the reaction raw material.

【Claim 18】 The apparatus according to claim 13, wherein the alcohol compound as the cocatalyst is selected from the group consisting of methanol, ethanol, propanol, isopropyl alcohol (isopropanol), butanol, and isobutanol, and the ether compound as the auxiliary cocatalyst is selected from the group consisting of dimethyl ether, diethyl ether, dipropyl ether, diisopropyl ether, isopropyl sec-butyl ether, sec-butyl ether, isoamyl ether, isopropyl isoamyl ether, and sec-butyl isoamyl ether.

【Claim 19】 A method of preparing polybutene having an easily controllable molecular weight, comprising:

(a) preparing a complex catalyst comprising an alcohol compound as a cocatalyst and boron trifluoride as a main catalyst;

(b) incorporating an ether compound as an auxiliary cocatalyst to the complex catalyst or a reaction raw material; and

(c) reacting a mixture of the auxiliary cocatalyst and the complex catalyst with the reaction raw material when the auxiliary cocatalyst is incorporated to the complex catalyst in Step (b) and reacting the complex catalyst with a mixture of the auxiliary cocatalyst and the reaction raw material when the auxiliary cocatalyst is incorporated to the reaction raw material, thereby polymerizing isobutene into polybutene.

【Claim 20】 The method according to claim 19, wherein the polymerizing is performed at a temperature of -40 to 20°C and a pressure of 3 kg/cm^2 or more for 5 to 100 minutes.

【Claim 21】 A highly reactive polybutene obtained by the method of preparing polybutene having an easily controllable molecular weight defined in claim 19.