Claims

1. A polyolefin resin satisfying all the following requirements (1) to (5):

(1) being polymerized in the presence of metallocene compounds represented by following formulas 1 to 4 as catalysts,

[Formula 1] $(L^1)(L^2)(X^1)(X^2)M^1$

[Formula 2] $(L^3)(L^4)(X^3)(X^4)M^2$

[Formula 3] $(L^5\text{-}Q^1{}_n\text{-}L^6)(X^5)(X^6)M^3$

[Formula 4] $(L^7\text{-}Q^2{}_n\text{-}L^8)(X^7)(X^8)M^4$

wherein, M^1, M^2, M^3 and M^4 each is independently titanium (Ti), zirconium (Zr), or hafnium (Hf), L^1, L^2, L^3, L^4, L^5, L^6, L^7 and L^8 each is independently a cyclic hydrocarbyl group having 5 to 30 carbon atoms and having at least two conjugated double bonds, and X^1, X^2, X^3, X^4, X^5, X^6, X^7 and X^8 each is independently a halogen atom or a hydrocarbyl group, Q^1 and Q^2 each is independently a silane group or a hydrocarbyl group containing a substituent, and n is an integer of 1 to 5;

(2) having a matrix index of 2 or less and a melt strength of 4.0 Force (cN) or greater measured at 190 ºC, wherein the matrix index is calculated according to the following equation 1;

[Equation 1] $\text{Matrix Index} = (A + B - C)/C$

wherein A is the height of a peak having the lowest molecular weight in the molecular weight distribution graph measured by gel permeation chromatography; B is the height of a peak having the highest molecular weight; and C is the height of the deepest valley between the two peaks, wherein the matrix index approaches 1 as the medium molecular weight fills up between the bimodal molecular weights;

(3) having a melt flow index (MIP, 190 ºC, 5.0 kg load condition) of 0.01 to 5.0 g/10min;

(4) having a ratio (Mw/Mn, MWD) of weight average molecular weight (Mw) to number average molecular weight (Mn) in the range from 5 to 35 as measured by gel permeation chromatography; and

(5) having bimodal or multimodal molecular weight distribution measured

by gel permeation chromatography, wherein the height ratio of two peaks (the ratio of the height of low molecular weight peak to the height of high molecular weight peak) is 1 to 2.

2. The polyolefin resin as claimed in claim 1, further satisfying all the following requirements (7), (8) and (9):

(7) having a density (d) of 0.930 to 0.965 g/cm^3;

(8) having a peak (M_{Lp}) for the lowest molecular weight in the molecular weight distribution appearing in the molecular weight range of 10,000 to 100,000 according to gel permeation chromatography measurement; and

(9) having a peak (M_{Hp}) for the highest molecular weight appearing in the molecular weight range of 300,000 to 3,000,000 according to gel permeation chromatography measurement.

3. The polyolefin as claimed in claim 1, wherein the polyolefin resin has a melt flow index of 15 to 50, and the melt flow index is defined as the ratio of high-load melt flow index (190 ºC, 21.6 kg/10min load condition) to melt flow index (190 ºC, 5.0 kg load condition).

4. The polyolefin resin as claimed in claim 1, wherein the polyolefin resin has a shear thinning index of 45 to 100 measured at 190 ºC, and the shear thinning index is calculated according to the following Equation 2:

[Equation 2] $STI = \eta_{0.1} / \eta_{100}$

where $\eta_{0.1}$ is a viscosity at deformation rate of 0.1 rad/s; and η_{100} is a viscosity at deformation rate of 100 rad/s.

5. The polyolefin resin as claimed in claim 1, wherein the polyolefin resin has a modulus ratio index of 20 to 200, and the modulus ratio index is calculated according to the following Equation 3:

[Equation 3] Modulus ratio index = $G'_{100}/ G'_{0.1}$

wherein G'_{100} is a storage modulus at deformation rate of 0.1 rad/s; and

$G'_{0.1}$ is a storage modulus at deformation rate of 100 rad/s.

6. A polyolefin resin satisfying all the following requirements (1), (4), (5) and (6):

(1) Being polymerized in the presence of metallocene compounds represented by following formulas 1 to 4 as catalysts,

[Formula 1] $(L^1)(L^2)(X^1)(X^2)M^1$

[Formula 2] $(L^3)(L^4)(X^3)(X^4)M^2$

[Formula 3] $(L^5\text{-}Q^1_n\text{-}L^6)(X^5)(X^6)M^3$

[Formula 4] $(L^7\text{-}Q^2_n\text{-}L^8)(X^7)(X^8)M^4$

wherein, M^1, M^2, M^3 and M^4 each is independently titanium (Ti), zirconium (Zr), or hafnium (Hf), L^1, L^2, L^3, L^4, L^5, L^6, L^7 and L^8 each is independently a cyclic hydrocarbyl group having 5 to 30 carbon atoms and having at least two conjugated double bonds, and X^1, X^2, X^3, X^4, X^5, X^6, X^7 and X^8 each is independently a halogen atom or a hydrocarbyl group, Q^1 and Q^2 each is independently a silane group or a hydrocarbyl group containing a substituent, and n is an integer of 1 to 5;

(4) The ratio (Mw/Mn, MWD) of weight average molecular weight (Mw) to number average molecular weight (Mn) is 5 to 35 measured by gel permeation chromatography;

(5) In the weight average molecular weight distribution measured by gel permeation chromatography, bimodal or multimodal peaks appear, where the height ratio of the height of low molecular weight peak to the height of high molecular weight peak is 1 to 2;

(6) In the correlation function of melt strength (Y) and matrix index (X), $Y \geq -0.74X + 5.3$, and the matrix index is calculated according to the following equation 1;

[Equation 1] $\text{Matrix Index} = (A + B - C)/C$

wherein A is the height of a peak having the lowest molecular weight in the molecular weight distribution graph measured by gel permeation chromatography; B is the height of a peak having the highest molecular weight;

and C is the height of the deepest valley between the two peaks, wherein the matrix index approaches 1 as the medium molecular weight fills up between the bimodal molecular weights.

7. The polyolefin resin as claimed in claim 6, wherein the polyolefin resin satisfies all the following requirements (3), (7), (8) and (9):

(3) having a melt flow index (MIP, 190 ºC, 5.0 kg load condition) of 0.01 to 5.0 g/10min;

(7) having a density (d) of 0.930 to 0.965 g/cm^3;

(8) having a peak (M_{Lp}) for the lowest molecular weight in the molecular weight distribution appearing in the molecular weight range of 10,000 to 100,000 according to gel permeation chromatography measurement; and

(9) having a peak (M_{Hp}) for the highest molecular weight appearing in the molecular weight range of 300,000 to 3,000,000 according to gel permeation chromatography measurement.

8. The polyolefin as claimed in claim 6, wherein the polyolefin resin has a melt flow index of 15 to 50, and the melt flow index is defined as the ratio of high-load melt flow index (190 ºC, 21.6 kg/10min load condition) to melt flow index (190 ºC, 5.0 kg load condition).

9. The polyolefin resin as claimed in claim 6, wherein the polyolefin resin has a shear thinning index of 45 to 100 measured at 190 ºC, and the shear thinning index is calculated according to the following Equation 2:

[Equation 2] $STI = \eta_{0.1} / \eta_{100}$

where $\eta_{0.1}$ is a viscosity at deformation rate of 0.1 rad/s; and η_{100} is a viscosity at deformation rate of 100 rad/s.

10. The polyolefin resin as claimed in claim 6, wherein the polyolefin resin has a modulus ratio index of 20 to 200, and the modulus ratio index is calculated according to the following Equation 3:

[Equation 3] Modulus ratio index = $G'_{100}/ G'_{0.1}$

wherein G'_{100} is a storage modulus at deformation rate of 0.1 rad/s; and $G'_{0.1}$ is a storage modulus at deformation rate of 100 rad/s.

11. A molded product comprising a polyolefin resin of claim 1 or claim 6, wherein the molded product is selected from the group consisting of a blow molded article, an inflated molded article, a cast molded article, an extruded laminated molded article, an extrusion molded articles, a foamed molded article, an injection molded articles, a sheet, a film, a fiber, a monofilament, and a nonwoven fabric.