succinate, and polylactic acid). These other thermoplastic resins may be used singly or in combination of two or more of them.

Examples of the filler include glass components (e.g., glass fibers, glass beads, glass flakes), silica, inorganic fibers (glass fibers, alumina fibers, carbon fibers), graphite, silicate compounds (e.g., calcium silicate, aluminum silicate, montmorillonite, kaolin, talc, clay), metal oxides (e.g., iron oxide, titanium oxide, zinc oxide, antimony oxide, alumina), carbonates and sulfates of metals such as lithium, calcium, magnesium, and zinc, metals (e.g., aluminum, iron, silver, copper), hydroxides (e.g., aluminum hydroxide, magnesium hydroxide), sulfides (e.g., barium sulfate), carbides (e.g., wood charcoal, bamboo charcoal), titanides (e.g., potassium titanate, barium titanate), organic fibers (e.g., aromatic polyester fibers, aromatic polyamide fibers, fluororesin fibers, polyimide fibers, plant fibers), and celluloses (e.g., cellulose microfibrils, cellulose acetate). These fillers may be used singly or in combination of two or more of them. These fillers can be used also as nucleating agents.

[0045]

<6> Phase structure

The phase structure of the thermoplastic resin composition according to the present invention is not limited, but the thermoplastic resin composition according to the present invention can have the following phase structure (1), (2), or (3).

Phase structure (1): A phase structure having a continuous phase (A) containing a polyolefin resin and a dispersed phase (B) dispersed in the continuous phase (A) and containing a polyamide resin and a modified elastomer (see FIG. 1). It is to be noted that the phase structure (1) does not coexist with another phase structure having a continuous phase containing a polyamide resin and a dispersed phase dispersed in the continuous phase.

Phase structure (2): A phase structure having a continuous phase containing a polyamide resin and a dispersed phase dispersed in the continuous phase and containing a polyolefin resin. It is to be noted that the phase structure (2) does not coexist with another phase structure having a continuous phase containing a polyolefin resin and a dispersed phase dispersed in the continuous phase.

Phase Structure (3): A phase structure having a continuous phase (A_1) containing a polyolefin resin, a dispersed phase (B_{A1}) dispersed in the continuous phase (A_1) and containing a polyamide resin and a modified elastomer, a continuous phase (A_2) containing a polyamide resin, and a dispersed phase (B_{A2}) dispersed in the continuous phase (A_2) and containing a modified elastomer (see FIG. 2).

Among these phase structures, the phase structure (1) or the phase structure (3) is preferred.

[0046]

In the phase structure (1), the dispersed phase (B) may further have a continuous phase (B_1) present in the dispersed phase (B) and containing a polyamide resin and a fine dispersed phase (B_2) dispersed in the continuous phase (B_1) and containing a modified elastomer (see FIG. 1). In this case, the phase structure (1) is a multiple phase structure in which the fine dispersed phase (B_2) is further dispersed in the dispersed phase (B).

composition is on standby at a shear rate of 0 sec^{-1} or more but less than 80 sec^{-1} after the molding step.

[0077]

The "molding step" is a step in which the softened or melted thermoplastic resin composition is molded at a shear rate of 80 sec^{-1} or more. As described above, the thermoplastic resin composition according to the present invention can show high fluidity suitable for versatile molding methods at a shear rate of 80 sec^{-1} or more. Therefore, the molding step can be performed using, for example, extrusion molding or injection molding.

[0078]

The "standby step" is a step in which a shear rate of 0 sec^{-1} or more but less than 80 sec^{-1} is used. The length of standby time is not particularly limited, but may be, for example, 0.1 seconds or more (usually 300 seconds or less), 0.2 seconds or more but 180 seconds or less, 0.3 seconds or more but 120 seconds or less, 0.4 seconds or more but 60 seconds or less, or 0.5 seconds or more but 30 seconds or less.

The standby step may be performed in a state where forced cooling (e.g., cooling by wind, cooling by contact with a cooling medium) is not performed. More specifically, the standby step may be performed in, for example, a natural cooling state or a heating state. That is, the production method using the thermoplastic resin composition according to the present invention makes it possible to maintain the shape of a precursor even in a state where forced cooling is not performed. The same applies to a case where the standby step is performed in a heating state.

[0079]

Examples of the standby step include a standby step in which a molded body obtained by extrusion molding is on standby until it is cut and a standby step in which a molded body obtained by injection molding is removed from a mold after mold opening and is on standby until a resin is sufficiently cooled and solidified.

Further, the production method according to the present invention is suitable for various blow molding methods in addition to the above-described molding methods. Blow molding is performed through an upstream step in which a parison (precursor molded body) is formed, a standby step, and a downstream step in which the parison is subjected to blowing. As described above, the melt viscosity of the thermoplastic resin composition according to the present invention in a low shear rate range can be made, for example, 6.5 times or more higher than that in a high shear rate range. Therefore, the thermoplastic resin composition according to the present invention can maintain a high viscosity and have shape retentivity even in a fluidized state when a shear stress is not applied. On the other hand, if necessary, the thermoplastic resin composition according to the present invention can be molded with a high degree of freedom by applying a high shear rate. Therefore, in the case of blow molding, it is possible to highly prevent a parison from having an uneven thickness (that is, it is possible to prevent a parison from being deformed) and it is possible to use an apparatus having no means for maintaining the shape of a parison, such as a parison controller. A resulting molded body can have a desired thickness (film thickness) accurately controlled.

[0080]

(1) Thermoplastic resin composition of Example 1

Pellets of the following polyamide resin and pellets of the following modified elastomer were dry-blended, then fed into a twin screw melt-kneading extruder, and melt-kneaded at a melt-kneading temperature of 210°C. The thus obtained melt-kneaded product of the polyamide resin and the modified elastomer was pelletize by a pelletizer to obtain pellets of the melt-kneaded product. Further, the pellets (pellets of the melt-kneaded product of the polyamide resin and the modified elastomer) and pellets of the following polyolefin resin were dry-blended, then fed into a twin screw melt-kneading extruder, melt-kneaded at a melt-kneading temperature of 210°C, and pelletized by a pelletizer to obtain pellets made of a thermoplastic resin composition (Example 1).

[0087]

The thermoplastic resin composition of Example 1 contained the polyolefin resin, the polyamide resin, and the modified elastomer in a mass ratio of 55 : 25 : 20. The thermoplastic resin composition having such a mass ratio has a phase structure (1) (see FIG. 1).

• Polyolefin resin: polypropylene resin, homopolymer, manufactured by Japan Polypropylene Corporation under the trade name of "NOVATEC MA1B", weight-average molecular weight: 312,000, melting point: 165°C)

• Polyamide resin: Nylon 11 resin, manufactured by Arkema under the trade name of "Rilsan BMNO", weight-average molecular weight: 18,000, melting point: 190°C

• Modified elastomer: maleic anhydride-modified ethylene-butene copolymer (modified EBR), manufactured by Mitsui Chemicals, Inc. under the trade name of "TAFMER MH7020"

[0088]

(2) Thermoplastic resin composition of Example 2

Pellets made of a thermoplastic resin composition (Example 2) were obtained in the same manner as in Example 1 described above. The thermoplastic resin composition of Example 2 contains the polyolefin resin, the polyamide resin, and the modified elastomer in a mass ratio of 32.5 : 42.5 : 25. The thermoplastic resin composition having such a mass ratio has a phase structure (3) (see FIG. 2). It is to be noted that the polyolefin resin, the polyamide resin, and the modified elastomer used are all the same as those used in Example 1.

[0089]

(3) Thermoplastic resin composition of Comparative Example 1

As a thermoplastic resin composition of Comparative Example 1, pellets of the following resin were used.

• Block-type polyolefin resin: polypropylene resin, block polymer, manufactured by Prime Polymer Co., Ltd. under the trade name of "J-452HP".

[0090]

(4) Thermoplastic resin composition of Comparative Example 2

As a thermoplastic resin composition of Comparative Example 2, pellets of the following resin were used.

• Talc-containing polyolefin resin: polypropylene (block polymer) containing 15% by mass of talc with respect to its total mass (100% by mass)

[0091]

[2] Evaluation of shear-rate dependence

The melt viscosities of each of the thermoplastic resin compositions (pellets) of Examples 1 and 2 and Comparative Examples 1 and 2 obtained above in [1] at various shear rates were measured under the following measuring conditions. The obtained results are shown in Table 1 and FIGs. 6 and 7.

Test standard: JIS K7199; 1999

Test machine: Capillary rheometer (manufactured by Toyo Seiki Seisaku-sho, Ltd., Type "Capilograph-1D")

Test temperature: 200°C

Extrusion rate: 200 to 1 mm/min (shear rate: 12.16 to 2432 sec^{-1})

Nozzle shape: L = 10.0 mm, D = 1.0 mm, Inflow angle: 180 degrees

Drying conditions: vacuum drying 80°C × 8 hours or more

[0092]

[Table 1]

		Example 1	Example 2	Comparative Example 1	Comparative Example 2
Extrusion rate (mm/min)	Shear rate (sec^{-1})	Melt viscosity (Pa·s)	Melt viscosity (Pa·s)	Melt viscosity (Pa·s)	Melt viscosity (Pa·s)
200.0	2.432E+03	1.174E+02	1.680E+02	5.757E+01	6.379E+01
100.0	1.216E+03	1.769E+02	2.510E+02	8.686E+01	9.196E+01
50.0	6.080E+02	2.633E+02	3.640E+02	1.305E+02	1.312E+02
20.0	2.432E+02	4.406E+02	5.630E+02	2.200E+02	2.048E+02
10.0	1.216E+02	6.643E+02	7.670E+02	3.129E+02	2.852E+02
5.0	6.080E+01	1.008E+03	1.081E+03	4.277E+02	3.901E+02
2.0	2.432E+01	1.702E+03	1.763E+03	6.142E+02	5.706E+02
1.0	1.216E+01	2.525E+03	2.501E+03	7.895E+02	7.630E+02

[0093]

[3] Evaluation of MFR

MFR of each of the thermoplastic resin compositions (pellets) of Examples 1 and 2 and Comparative Examples 1 and 2 obtained above in [1] at various shear rates were measured under the following measuring conditions.

Test standard: JIS K7120

Test machine: Melt indexer (manufactured by Toyo Seiki Seisaku-sho Ltd., Type "F-F01")

Test temperature: 230°C

Test load: 2.16 kgf

Drying conditions: vacuum drying 80°C × 8 hours or more