of the suspension or the solution in a nonpolar hydrocarbon solvent or in concentrated organoaluminium as part of the catalyst system for the alpha-olefin polymerization. Suitable nucleating agents include compounds based on benzene trisamides. The reference describes polymer suitable for in situ nucleation involves ethylene and propylene homopolymers as well as mutual copolymers.

WO 2004/072168 describes a composition containing a) a natural or synthetic polymer and b) one or more compounds based on benzene trisamide structures. The compositions are said to have excellent crystallizability, high transmittance, low haze and/or improved thermal stability. Examples of synthetic polymers are said to be polymers of monoolefins preferably being polyethylene and polypropylene.

An objective of the present invention is to provide improvements to melt strength and/or melt elasticity and/or the drawability of polyethylenes. In particular, there is a desire to improve melt strength and/or melt elasticity and/or drawability of polyethylene during processing, especially during the extrusion of polyethylene, and more especially during the extrusion of polyethylene to produce films or fibres. This would particularly be the case for blown ethylene film production. Such improvements are desirable for mono and biaxial orientated polyethylene films (BOPE).

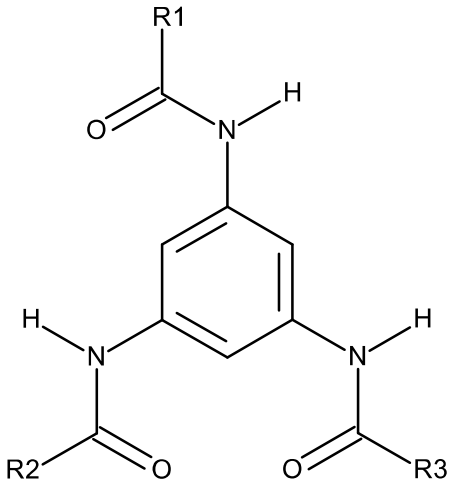
Summary

In accordance with the present disclosure, we provide a use of an additive for increasing the melt strength and/or melt elasticity and/or the drawability of a polyethylene, wherein the additive is selected from at least one compound selected from the group consisting of bisamides, trisamides, tetraamides and sorbitol acetals.

The disclosure also provides a method for increasing the melt strength and/or melt elasticity and/or the drawability of polyethylene by adding an additive to the polyethylene, wherein the additive is selected from the group consisting of bisamides, trisamides, tetraamides and sorbitol acetals.

Additionally provided in accordance with the present disclosure is a polyethylene of improved melt strength and/or melt elasticity and/or drawability, comprising an additive for increasing the melt strength and/or melt elasticity and/or the drawability of the polyethylene, which additive is selected from the group consisting of bisamides, trisamides, tetraamides and sorbitol acetals.

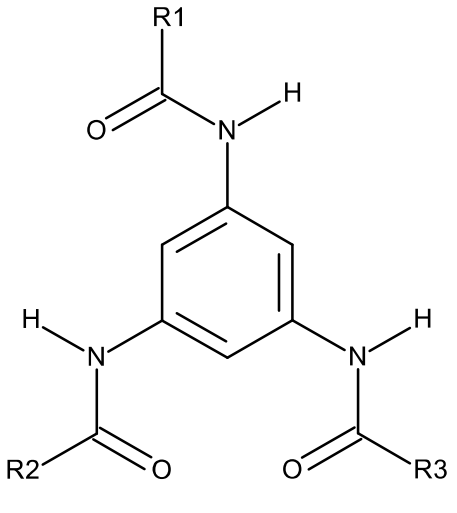
In an aspect, there is provided a use of an additive for increasing the melt strength and/or the drawability tested with a rheotense test device of a polyethylene, wherein the additive is at least one compound selected from the group consisting of trisamides, wherein the trisamide is an aromatic trisamide of the formula (VII)



(VII),

wherein R1, R2 and R3 are each independently selected from C_1-C_5 linear or branched alkyl or substituted or unsubstituted C_3-C_6 cycloalkyl; and wherein the polyethylene comprises the additive in an amount of from 0.005 to 0.1 wt. %.

In another aspect, there is provided a method for increasing the melt strength and/or the drawability tested with a rheotense test device of polyethylene by adding an additive to the polyethylene, wherein the additive is selected from the group consisting of trisamides, wherein the trisamide is an aromatic trisamide of the formula (VII)



(VII),

wherein R1, R2 and R3 are each independently selected from C_1-C_5 linear or branched alkyl or substituted or unsubstituted C_3-C_6 cycloalkyl; and wherein the polyethylene comprises the additive in an amount of from 0.005 to 0.1 wt. %.

Detailed Description of the Invention

Inventors have found that compounds in the categories of bisamides, trisamides, tetraamides and sorbitol acetals can be used in the processing of polyethylene to achieve the aforementioned objectives. The incorporation of bisamides, trisamides, tetraamides or sorbitol acetals into the polyethylene processing can improve the melt strength as well after melt elasticity and can improve the drawability of the molten polyethylene.

The polyethylene may be any of ultrahigh molecular weight polyethylene (UHMWPE), ultra-low molecular weight polyethylene (ULMWPE or PE-WAX), high molecular weight polyethylene (HMWPE), high density polyethylene (HDPE), high density cross-linked polyethylene (HDXLPE), cross-linked polyethylene (PEX or XLPE), medium density polyethylene (MDPE), linear low density polyethylene (LLDPE), low density polyethylene (LDPE), very low density polyethylene (VLDPE) or chlorinated polyethylene (CPE).

Preferably, the polyethylene has a density of from 0.915 to 0.960 g/cm³, preferably from 0.915 to 0.950 g/cm³.

Suitably the polyethylene may be an ultrahigh molecular weight polyethylene (UHMWPE). Such UHMWPE may have a molecular weight of several million, for instance from 3.5 to 7.5 million g/mol. Typically, the density tends to be less than high density polyethylene and may be in the range of from 0.930 to 0.935 g/cm³.

High density polyethylene (HDPE) may also be processed in accordance with the present invention, especially if the density does not exceed 0.960 g/cm³. Typically, HDPE has a density of greater than 0.941 g/cm³.