There is therefore a need to find a non-aromatic peroxide which does not exhibit these drawbacks and which is significantly greater in efficacy than tert-butyl peroxy-3,5,5-trimethylhexanoate.

In the implementation of a process for preparing polyethylene or an ethylene copolymer, it is conventional practice to inject an organic peroxide or a collective of organic peroxides (commonly referred to as a cocktail of organic peroxides) into one or more reaction zones of a reactor in order to bring about the radical polymerization or copolymerization of ethylene under high pressure. In particular, it is known practice to inject a collective of organic peroxides which are capable of initiating the radical polymerization or copolymerization reaction of ethylene within different temperature ranges, for example in a temperature range of from 160°C to 240°C and in a temperature range of from 240°C to 280°C, into two or more reaction zones of a reactor. This type of system of peroxidic initiators including one initiator more reactive than the others has the advantage of covering a wide range of initiation temperatures for the ethylene polymerization or copolymerization reaction.

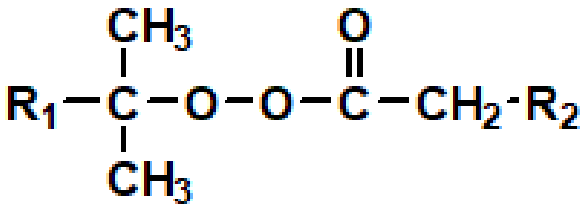
One of the objectives of the present disclosure, therefore, is to propose a compound or an association of compounds that is capable of initiating the radical polymerization or copolymerization reaction of ethylene under high pressure in a reliable way while reducing the amount of initiator(s) consumed during the reaction relative to the organic peroxides conventionally used in the prior art.

In other words, there is a genuine need for effective replacement of some or all of the organic peroxides conventionally used in the radical polymerization or copolymerization of ethylene under high pressure by a system containing one or more initiators that is easy to store, handle and/or transport, and which is capable of reducing the specific consumption of initiator(s) employed in the radical polymerization or copolymerization reaction.

More particularly, one of the objectives of the present disclosure is to provide a system containing one or more initiators for the radical polymerization or copolymerization of ethylene under high pressure so as to enhance the productivity and the rationalization of the production costs of a process for preparing polyethylene or an ethylene-based copolymer.

A subject of the present disclosure especially is the use of at least one organic peroxide, alone or in combination with one or more distinct additional organic peroxide(s), selected from the group consisting of the peresters of formula (I) below:

[Chem 1]



in which formula (I):

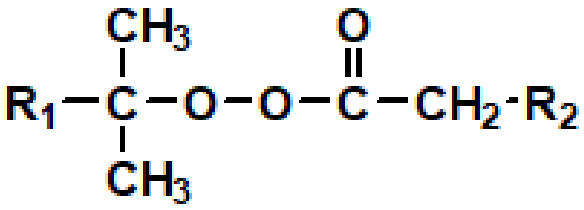
R_1 represents a linear or branched, nonaromatic, C_1-C_{10} alkyl group, and

R_2 represents a linear C_1-C_{16} alkyl group,

for the radical polymerization or copolymerization of ethylene under high pressure.

In one aspect, there is provided the use of at least one organic peroxide, alone or in combination with one or more distinct additional organic peroxides, selected from the group consisting of the peresters of formula (I) below:

[Chem 1]



in which formula (I):

- R_1 represents a linear or branched, non-aromatic, C_1-C_{10} alkyl group, and
- R_2 represents a linear- C_1-C_{16} alkyl group,

for the radical polymerization or copolymerization of ethylene under high pressure.

In another aspect, the present disclosure refers to a process for preparing polyethylene or an ethylene copolymer, comprising a step of radical polymerization or copolymerization of ethylene under high pressure in the presence of at least one organic peroxide as defined above, alone or in combination with one or more distinct additional peroxides as defined above.

In another aspect, the present disclosure refers to a composition comprising:

(i) at least one olefinic monomer,
(ii) at least one peroxide selected from the group consisting of peresters as defined above, and
(iii) optionally at least one additional peroxide, distinct from the peroxide (ii), as defined above.

The organic peroxide according to the disclosure is used in particular, alone or in combination with one or more distinct additional organic peroxides, for initiating the polymerization or copolymerization of ethylene by a radical route under high pressure.

In other words, the disclosure proposes using a peroxidic initiator system composed of one or more organic peroxides in which at least one organic peroxide is selected from the group consisting of the peresters of formula (I) for the radical polymerization or copolymerization of ethylene under high pressure, especially for initiating the radical polymerization or copolymerization of ethylene under high pressure.

An advantage of the organic peroxide as defined above, alone or in combination with one or more distinct additional organic peroxides, is the effective initiation of the radical polymerization or copolymerization of ethylene under high pressure so as to produce polyethylene or an ethylene-based copolymer.

Thus the use of the organic peroxide according to the disclosure enables effective replacement of some or all of the organic peroxides conventionally used in the prior art for the radical polymerization or copolymerization of ethylene under high pressure.

Moreover, the organic peroxide according to the disclosure also has the advantage of having a self-accelerating exothermic decomposition temperature of greater than 50°C, which allows it to be stored, transported and handled at room temperature.

Moreover, the peroxidic initiator system according to the disclosure enables a reduction in the specific consumption of initiator(s) for a given injection zone, whether the consumption of the organic peroxide, as defined above, when it is used alone, or the overall consumption of the mixture of organic peroxides containing the organic peroxide as defined above and the additional organic peroxide(s).

More generally, the specific consumption of the organic peroxide according to the disclosure, when it is used alone, and the overall specific consumption of a combination of organic peroxides based on the organic peroxide according to the disclosure and one or more additional organic peroxides are reduced during the radical polymerization or copolymerization of ethylene under high pressure, relative to the organic peroxides used in the prior art.

Consequently, the organic peroxide according to the disclsoure or the system containing an organic peroxide of this kind has an economic advantage associated with the limitation to the costs of producing polyethylene or ethylene-based copolymer(s), and an environmental advantage linked to the limitation to risks of producing volatile organic compounds resulting from the breakdown of the organic peroxide(s) employed.

In the sense of the present disclosure, “specific consumption of initiator(s)” refers to the amount in kilograms of initiator that is needed to produce one metric ton of polymer (resin). The specific consumption of initiator(s) may also be expressed in grams of initiator(s) per kilogram of polymer obtained.

Moreover, the peroxidic initiator system according to the disclosure is able to span a wide range of initiation temperatures for the radical polymerization or copolymerization of ethylene.

The disclosure also concerns a process for preparing polyethylene or an ethylene copolymer, comprising a step of radical polymerization or copolymerization of ethylene under high pressure in the presence of at least one organic peroxide selected from the group consisting of the peresters of formula (I), alone or in combination with one or more distinct additional organic peroxides.

The present disclosure also relates to a composition comprising:

(i) at least one olefinic monomer,

(ii) at least one perester of formula (I) as defined above, and

(iii) optionally at least one additional organic peroxide distinct from the peroxide (ii).

The composition enables a reduction in the specific consumption of initiator(s) relative to the organic peroxides conventionally used in the preparation of polyethylene or of ethylene copolymer(s).

The composition according to the disclosure allows the polymerization to result in polyethylene or an ethylene-based copolymer.

The composition according to the disclosure is therefore polymerizable or able to polymerize.

In the sense of the present disclosure, “high pressure” means a pressure of greater than 50 MPa. Preferably, the pressure varies from 500 bar (50 MPa) to 3000 bar (300 MPa), preferentially from 1200 bar (120 MPa) to 3000 bar (300 MPa).

Other features and advantages of the disclosure will emerge more clearly on reading the description and the examples that follow.

In the following text, and unless otherwise indicated, the limits of a range of values are included in this range.

The expression “at least one” is equivalent to the expression “one or more”.

Organic peroxide

As indicated above, the invention pertains to the use of one or more peresters corresponding to the formula (I) described above for the radical polymerization or copolymerization of ethylene under high pressure.

The term “nonaromatic” is understood to mean, within the meaning of the present invention, that R_1 does not comprise an aromatic ring.

In other words, R_1 represents an aliphatic C_1-C_{10} alkyl group.