Abstract:

Provided are a polypropylene composition (PP), an article comprising said polypropylene composition (PP) as well as the use of said polypropylene composition (PP) for the preparation of a moulded article and the use of said polypropylene composition (PP) for reducing tiger stripes on the surface.
PP Compounds with Alleviated or Eliminated Tiger Stripe and Retained Excellent Mechanical Properties

The invention relates to a polypropylene composition (PP), an article comprising said polypropylene composition (PP) as well as the use of said polypropylene composition for the preparation of a moulded article and the use of said polypropylene composition (PP) for reducing tiger stripes on the surface of an article.

Nowadays, polypropylene is the polymer of choice for automobile parts like bumpers, door panels, dashboards or door claddings. In particular, heterophasic propylene copolymers are suitable as they combine stiffness with good impact behavior. Heterophasic propylene copolymers are well known in the art and comprise a matrix being either a polypropylene homopolymer or a random polypropylene copolymer in which an elastomeric copolymer is dispersed. Thus, the polypropylene matrix contains (finely) dispersed inclusions being not part of the matrix and said inclusions contain the elastomer. The term inclusion indicates that the matrix and the inclusion form different phases within the heterophasic propylene copolymer, said inclusions are for instance visible by high resolution microscopy, like electron microscopy or scanning force microscopy.

Even though the polypropylenes on the market achieve a very good balance between stiffness and impact, the overall profile requirements for such systems become ever more demanding. For instance, the polypropylenes are typically injection moulded into the desired articles like automotive and household articles. As the articles are, however, relatively large, such as for example automobile bumpers, door panels, dashboards or door claddings, optical irregularities often occur due to the necessary long flow paths of the polypropylene resin.

Such surface defects, which are also known as tiger stripes, flow marks or flow lines, are deteriorating the surface aesthetics since they manifest, during injection moulding, as a series of alternating high and low gloss strips perpendicular to the direction of the melt flow.

In this regard, many attempts to avoid these surface defects, while keeping a good balance of other physical properties, have been made, e.g. DE 19754061. It has, however, been found
that either the occurrence of tiger stripes could not be sufficiently prevented, or the mechanical properties of the polymer compositions were unsatisfactory.

Thus, there remains a need in the art to further reduce the occurrence of tiger stripes. In addition thereto, there is not only the need to reduce the occurrence of tiger stripes but also the need to keep the mechanical properties such as impact/stiffness behavior on a very high level.

Accordingly, the object of the present invention is to provide a polypropylene composition exhibiting no tiger stripes at all or only minor tiger stripes on the surface of articles made therefrom. In addition thereto, it is an object of the present invention to provide not only a polypropylene composition exhibiting no tiger stripes but also to maintain mechanical properties, such as excellent balanced stiffness/impact behaviour.

The foregoing and other objectives are solved by the subject-matter of the present invention.

The specific finding of the present invention is to provide a polypropylene composition (PP) comprising a combination of two heterophasic propylene copolymers which differ in their melt flow rate MFR and which are present in specific amounts.

According to a first aspect of the present invention, a polypropylene composition (PP) is provided, said polypropylene composition (PP) comprises

a) a first heterophasic propylene copolymer (HPP1) having a melt flow rate MFR (230 °C, 2.16 kg) of from 20.0 to 80.0 g/10 min, and

b) a second heterophasic propylene copolymer (HPP2) having a melt flow rate MFR (230 °C, 2.16 kg) of from 0.05 to 2.0 g/10 min,

wherein

i) the amount of the first heterophasic propylene copolymer (HPP1) is in the range of from 66.6 to 95.2 wt.-%, based on the total weight of the first heterophasic propylene copolymer (HPP 1) and of the second heterophasic propylene copolymer (HPP2), and
ii) the amount of the second heterophasic propylene copolymer (HPP2) is in the range of from 4.8 to 33.4 wt.-%, based on the total weight of the first heterophasic propylene copolymer (HPP1) and of the second heterophasic propylene copolymer (HPP2).

It has been surprisingly found out that the polypropylene composition (PP) according to this invention exhibits no tiger stripes at all or only minor tiger stripes on the surface of articles made therefrom. Furthermore, a part of the polypropylene compositions (PP) according to this invention not only exhibits no tiger stripes but also has important mechanical properties, like stiffness and impact behaviour are also on a high level, comparable with prior art products.

It should be understood that for the purposes of the present invention, the following terms have the following meanings:

The expression "heterophasic" indicates that an elastomeric copolymer is (finely) dispersed in a matrix. In other words, the elastomeric propylene copolymer forms inclusions in the matrix. Thus, the matrix contains (finely) dispersed inclusions being not part of the matrix and said inclusions contain the elastomeric propylene copolymer. The term "inclusion" according to this invention shall preferably indicate that the matrix and the inclusion form different phases within the heterophasic propylene copolymer, said inclusions are for instance visible by high resolution microscopy, like electron microscopy or scanning force microscopy.

The final composition is probably of a complex structure. For example, the matrices of the heterophasic propylene copolymers may form a continuous or incontinuous phase being the matrix of the composition wherein the elastomeric copolymers and optional additives form together or individually inclusions dispersed therein.

According to another aspect of the present invention, an article is provided, the article comprises, preferably consists of, said polypropylene composition (PP). It is preferred that the article is a moulded article, preferably an injection moulded article. A still further aspect
of the present invention is directed to the use of said polypropylene composition (PP) for the preparation of a moulded article, preferably an injection moulded article. An even further aspect of the present invention is directed to the use of said polypropylene composition (PP) in the preparation of an article for reducing tiger stripes on the surface of the article.

When in the following reference is made to preferred embodiments or technical details of the inventive polypropylene composition (PP), it is to be understood that these preferred embodiments or technical details also refer to the inventive article comprising the polypropylene composition (PP) as well as the inventive use of the polypropylene composition (PP) for the preparation of a molded article and the inventive use of the polypropylene composition (PP) in an article for reducing tiger stripes on the surface of the article.

According to one embodiment of the present invention, the first heterophasic propylene copolymer (HPP1) has a) a melt flow rate MFR₂ (230 °C, 2.16 kg) of from 20.0 to 75.0 g/10 min, and/or b) a xylene cold soluble (XCS) fraction (25 °C) of from 15.0 to 25.0 wt.-%, based on the total weight of the first heterophasic propylene copolymer (HPP1), and/or c) an ethylene content of < 15.0 wt.-%, based on the total weight of the first heterophasic propylene copolymer (HPP1), and/or d) an amorphous (AM) phase having an intrinsic viscosity (IV) of from 2.0 to 3.0 dl/g, and/or e) an amorphous (AM) phase having an ethylene content of 33.0 to 40.0 wt.-%, based on the total weight of the amorphous (AM) phase of the first heterophasic propylene copolymer (HPP1).

According to another embodiment of the present invention, the second heterophasic propylene copolymer (HPP2) has a) a melt flow rate MFR₂ (230 °C, 2.16 kg) of from 0.1 to 2.0 g/10 min, and/or b) a xylene cold soluble (XCS) fraction (25 °C) of from 9.0 to 20.0 wt.-%, based on the total weight of the second heterophasic propylene copolymer (HPP2), and/or c) an ethylene content of from 3.0 to 8.0 wt.-%, based on the total weight of the second heterophasic propylene copolymer (HPP2), and/or d) an amorphous (AM) phase having an intrinsic viscosity (IV) of from 3.0 to 4.0 dl/g, and/or e) an amorphous (AM) phase having an
ethylene content of 30.0 to 37.0 wt.-%, based on the total weight of the amorphous (AM) phase of the second heterophasic propylene copolymer (HPP2).

According to yet another embodiment of the present invention, the first heterophasic propylene copolymer (HPP1) comprises a polypropylene homopolymer matrix (PM1) and an elastomeric propylene copolymer (AM1) dispersed in said matrix (PM1) and/or the second heterophasic propylene copolymer (HPP2) comprises a polypropylene homopolymer matrix (PM2) and an elastomeric propylene copolymer (AM2) dispersed in said matrix (PM2). It is preferred that the polypropylene homopolymer matrix (PM1) of the first heterophasic propylene copolymer (HPP1) has a) a melt flow rate MFR$_3$ (230 °C, 2.16 kg) of from 30.0 to 250.0 g/10 min, and/or b) a xylene cold soluble (XCS) fraction (25 °C) of from 0.8 to 3.0 wt.-%, based on the total weight of the polypropylene homopolymer matrix (PM1) of the first heterophasic propylene copolymer (HPP1). It is also preferred that the polypropylene homopolymer matrix (PM2) of the second heterophasic propylene copolymer (HPP2) has a) a melt flow rate MFR$_2$ (230 °C, 2.16 kg) of from 0.1 to 3.0 g/10 min, and/or b) a xylene cold soluble (XCS) fraction (25 °C) of < 2.0 wt.-%, based on the total weight of the polypropylene homopolymer matrix (PM2) of the second heterophasic propylene copolymer (HPP2).

According to one embodiment of the present invention, the polypropylene composition (PP) comprises 40.0 - 60.0 wt.-%, based on the total weight of the polypropylene composition (PP), of the first heterophasic propylene copolymer (HPP1). 3.0 —20.0 wt.-%, based on the total weight of the polypropylene composition (PP), of the second heterophasic propylene copolymer (HPP2), 5.0 - 20.0 wt.-%, based on the total weight of the polypropylene composition (PP), of an elastomeric ethylene copolymer (EE) having a content of ethylene units of at least 50.0 wt.-%, based on the total weight of the elastomeric ethylene copolymer (EE), 5.0 - 10.0 wt.-%, based on the total weight of the polypropylene composition (PP), of a high density polyethylene (HDPE), and 15.0 - 25.0 wt.-%, based on the total weight of the polypropylene composition (PP), of an inorganic filler (F). The composition containing EE, HDPE and F can show excellent mechanical properties, such as excellent balanced stiffness/impact behaviour while exhibiting no tiger stripes.
According to another embodiment of the present invention, the elastomeric ethylene copolymer (EE) a) comprises ethylene units and comonomer units selected from C₄ to C₁₂ α-olefin, and/or b) has a content of ethylene units of from 50.0 to 75.0 wt.-%, based on the total weight of the elastomeric ethylene copolymer (EE), and/or c) has a melt flow rate MFRᵢ (190 °C, 2.16 kg) of from 0.25 to 30.0 g/10 min.

According to yet another embodiment of the present invention, the high density polyethylene (HDPE) has a melt flow rate MFR, (190 °C, 2.16 kg) of from 0.2 to 15.0 g/10 min, and/or a density of at least 930 kg/m³.

According to one embodiment of the present invention, the inorganic filler (F) is selected from the group consisting of talc, mica, calcium carbonate, diatomaceous, wollastonite and kaolin, and/or has an average particle size $d_{50}$ of from 0.65 to 20 μm.

According to another embodiment of the present invention, the polypropylene composition (PP) has a) a flexural modulus of at least 1500 MPa, and/or b) an izod notched impact strength (23 °C) of > 30 kJ/m².

According to yet another embodiment of the present invention, the first heterophasic propylene copolymer (HPP1) and/or the second heterophasic propylene copolymer (HPP2) are/is a-nucleated, preferably the first heterophasic propylene copolymer (HPP1) and the second heterophasic propylene copolymer (HPP2) are a-nucleated.

In the following the invention is described in more detail.

A polypropylene composition (PP) according to this invention comprises a first heterophasic propylene copolymer (HPP1) and a second heterophasic propylene copolymer (HPP2). Furthermore, the first heterophasic propylene copolymer (HPP1) has a melt flow rate MFR₂ (230 °C, 2.16 kg) measured according to ISO 1133 of from 20.0 to 80.0 g/10 min and the second heterophasic propylene copolymer (HPP2) having a melt flow rate MFR₂ (230 °C,
2.16 kg) measured according to ISO 1133 of from 0.05 to 2.0 g/10 min. In addition thereto, the amount of the first heterophasic propylene copolymer (HPP 1) is in the range of from 66.6 to 95.2 wt.-%, and the amount of the second heterophasic propylene copolymer (HPP2) is in the range of from 4.8 to 33.4 wt.-%, based on the total weight of the first heterophasic propylene copolymer (HPP1) and of the second heterophasic propylene copolymer (HPP2).

In one embodiment of the present invention, the polypropylene composition (PP) is preferably featured by a high stiffness, i.e. a flexurai modulus of at least 1,500 MPa, preferably of from 1,500 to 2,700 MPa and more preferably of from 1,600 to 2,600 MPa. For example, the inventive polypropylene composition (PP) is featured by a flexurai modulus of from 1,700 to 2,500 MPa, like from 1,720 to 2,500 MPa.

In one embodiment of the present invention, the polypropylene composition (PP) has a tensile strength of > 15 MPa, more preferably of > 17 MPa and most preferably of from > 17 to 30 MPa.

Additionally or alternatively, also the impact strength should be rather high. It is thus appreciated that the polypropylene composition (PP) is preferably featured by an Izod notched impact strength (+23 °C) of > 30 kJ/m², more preferably of ≥ 40 kJ/m². For example, the polypropylene composition (PP) is preferably featured by an Izod notched impact strength (+23 °C) in the range of from 40 to 60 kJ/m² or from 45 to 55 kJ/m².

It is appreciated that the polypropylene composition (PP) preferably has a flexurai modulus of at least 1500 MPa, and/or an izod notched impact strength (+23 °C) of > 30 kJ/m². In one embodiment of the present invention, the polypropylene composition (PP) has a flexurai modulus of at least 1500 MPa, and an izod notched impact strength (+23 °C) of > 30 kJ/m².

The polypropylene composition (PP) is in particular defined by the first heterophasic propylene copolymer (HPP1) and the second heterophasic propylene copolymer (HPP2).

Accordingly, all components are now defined in more detail.
The first heterophasic propylene copolymer (HPP 1) is preferably a heterophasic system in which the polypropylene homopolymer matrix (PM 1) as defined herein constitutes the matrix in which an elastomeric propylene copolymer (AMI) is dispersed.

Accordingly, the first heterophasic propylene copolymer (HPP 1) being part of the polypropylene composition (PP) comprises apart from propylene also comonomers. Preferably, the first heterophasic propylene copolymer (HPPI) being part of the polypropylene composition (PP) comprises apart from propylene ethylene and/or C 4 to C 12 a-olefins. Accordingly, the term first heterophasic propylene copolymer (HPPI) according to this invention is understood as a polypropylene comprising, preferably consisting of, units derivable from

(a) propylene
and
(b) ethylene and/or C 4 to C 12 a-olefins.

Thus, the first heterophasic propylene copolymer (HPPI) according to this invention, i.e. the first heterophasic propylene copolymer (HPPI) being part of the polypropylene composition (PP), comprises monomers copolymerizable with propylene, for example comonomers such as ethylene and/or C 4 to C 12 a-olefins, in particular ethylene and/or C 4 to C 8 a-olefins, e.g. 1-butene and/or 1-hexene. Preferably, the first heterophasic propylene copolymer (HPPI) according to this invention comprises, especially consists of, monomers copolymerizable with propylene from the group consisting of ethylene, 1-butene and 1-hexene. More specifically, the first heterophasic propylene copolymer (HPPI) of this invention comprises - apart from propylene - units derivable from ethylene and/or 1-butene. In a preferred embodiment, the first heterophasic propylene copolymer (HPPI) according to this invention comprises units derivable from propylene and ethylene only. Still more preferably only the elastomeric propylene copolymer (AMI 1) contains ethylene comonomers.

It is thus appreciated that the elastomeric propylene copolymer (AMI) dispersed in the polypropylene homopolymer matrix (PM 1) comprises propylene monomer units and
comonomer units selected from ethylene and/or C₄ to C₁₂ a-olefin. For example, the elastomeric propylene copolymer (AMI) dispersed in the polypropylene homopolymer matrix (PMI) comprises propylene monomer units and ethylene comonomer units.

Accordingly, the elastomeric propylene copolymer (AMI) is preferably an ethylene propylene rubber (EPR), whereas the matrix in which the elastomeric propylene copolymer (AMI) is dispersed is a polypropylene homopolymer matrix (PMI).

It is appreciated that the first heterophasic propylene copolymer (HPPl) being part of the polypropylene composition (PP) preferably has a comonomer content, preferably an ethylene content, of < 15.0 wt.-%, preferably < 12.0 wt.-%, more preferably from 3.0 to 10.0 wt.-% and most preferably from 5.0 to 10.0 wt.-%, based on the total weight of the first heterophasic propylene copolymer (HPPl).

The xylene cold soluble (XCS) fraction (23 °C) of the first heterophasic propylene copolymer (HPPl) being part of the polypropylene composition (PP) is preferably of from 15.0 to 25.0 wt.-%, preferably from 18.0 to 22.0 wt.-% and most preferably from 18.0 to 20 wt.-%, based on the total weight of the first heterophasic propylene copolymer (HPPl).

Additionally or alternatively, the first heterophasic propylene copolymer (HPPl) being part of the polypropylene composition (PP) has a melt flow rate MFR₂ (230 °C, 2.16 kg) of from 20.0 to 80.0 g/10 min, preferably from 20.0 to 75.0 g/10 min, more preferably from 20.0 to 60.0 g/10 min and most preferably from 30.0 to 50.0 g/10 min. For example, the first heterophasic propylene copolymer (HPPl) being part of the polypropylene composition (PP) has a melt flow rate MFR₂ (230 °C, 2.16 kg) of from 30.0 to 40.0 g/10 min or from 35.0 to 40.0 g/10 min.

The polypropylene homopolymer matrix (PMI) being part of the first heterophasic propylene copolymer (HPPl) is a propylene homopolymer. That is to say, the comonomer content of the polypropylene homopolymer matrix (PMI) is equal or below 0.5 wt.-%, more preferably equal or below 0.3 wt.-% and most preferably not more than 0.1 wt.-%. The
weight percentage is based on the total weight of the polypropylene homopolymer matrix (PM1).

In other words, the expression polypropylene homopolymer or polypropylene homopolymer matrix (PM1) as used throughout the instant invention relates to a polypropylene that consists substantially, i.e. of equal or more than 99.5 wt.-%, of propylene units. In a preferred embodiment only propylene units in the polypropylene homopolymer are detectable.

Furthermore, it is appreciated that the xylene cold soluble (XCS) fraction of the polypropylene homopolymer matrix (PM1) being part of the first heterophasic propylene copolymer (HPPl) is rather low. Accordingly, the xylene cold soluble (XCS) fraction of the polypropylene homopolymer matrix (PM1) (25 °C) is preferably of from 0.8 to 3.0 wt.-%, more preferably from 1.0 to 3.0 wt.-% and most preferably from 1.3 to 2.5 wt.-%, based on the total weight of the polypropylene homopolymer matrix (PM1) of the first heterophasic propylene copolymer (HPPl). For example, the xylene cold soluble (XCS) fraction of the polypropylene homopolymer matrix (PM1) (25 °C) is from 1.4 to 2.3 wt.-%, based on the total weight of the polypropylene homopolymer matrix (PM1) of the first heterophasic propylene copolymer (HPPl).

Additionally or alternatively, the polypropylene homopolymer matrix (PM1) being part of the first heterophasic propylene copolymer (HPPl) has a rather high melt flow rate. Accordingly, it is preferred that the polypropylene homopolymer matrix (PM1) has a melt flow rate MFR2 (230 °C, 2.16 kg) of from 30.0 to 250.0 g/10 min, preferably from 40.0 to 160.0 g/10 min, more preferably from 80.0 to 120.0 g/10 min, even more preferably from 90.0 to 110.0 g/10 min and most preferably from 95.0 to 105.0 g/10 min.

A further essential component of the first heterophasic propylene copolymer (HPPl) being part of the polypropylene composition (PP) is the elastomeric propylene copolymer (AM1) dispersed in the polypropylene homopolymer matrix (PM1).
Concerning the comonomers used in the elastomeric propylene copolymer (AMI) it is referred to the information provided for the first heterophasic propylene copolymer (HPP1). Accordingly, the elastomeric propylene copolymer (AMI) comprises monomers copolymerizable with propylene, for example comonomers such as ethylene and/or C4 to C12 a-olefins, in particular ethylene and/or C4 to C8 a-olefins, e.g. 1-butene and/or 1-hexene. Preferably, the elastomeric propylene copolymer (AMI) comprises, especially consists of, monomers copolymerizable with propylene from the group consisting of ethylene, 1-butene and 1-hexene. More specifically, the elastomeric propylene copolymer (AMI) comprises - apart from propylene - units derivable from ethylene and/or 1-butene. Thus, in an especially preferred embodiment the elastomeric propylene copolymer (AM1) comprises units derivable from propylene and ethylene only.

It is thus appreciated that the elastomeric propylene copolymer (AMI) dispersed in the polypropylene homopolymer matrix (PM1) comprises propylene monomer units and comonomer units selected from ethylene and/or C4 to C12 a-olefin. For example, the elastomeric propylene copolymer (AMI) dispersed in the polypropylene homopolymer matrix (PM1) comprises propylene monomer units and ethylene comonomer units.

Since the major amount of the elastomeric propylene copolymer (AMI) is soluble in xylene (XCS content; i.e. xylene cold soluble content) at ambient temperature, the XCS content of the first heterophasic polypropylene composition (HPP1) is related to the amount of elastomeric propylene copolymer (AMI), i.e. the amorphous phase, but it is not necessarily exactly the same. For example, the elastomeric propylene copolymer (AM1) may also comprise a portion with very high ethylene concentration, which is crystalline and would therefore be insoluble in cold xylene.

According to one embodiment of the present invention, the first heterophasic propylene copolymer (HPP1) being part of the polypropylene composition (PP) has an amorphous (AM) phase having an intrinsic viscosity (IV) of from 2.0 to 3.0 dl/g and preferably from 2.0 to 2.7 dl/g.
The comonomer content, preferably the ethylene content, within the elastomeric propylene copolymer (AMI) is comparatively low. Accordingly, in one embodiment the comonomer content, more preferably ethylene content, of the amorphous fraction of the first heterophasic propylene copolymer (HPP1) is of from 33.0 to 40.0 wt-%, preferably from 33.0 to 38.0 wt-% and most preferably from 34.0 to 38.0 wt-%, based on the total weight of the amorphous (AM) phase of the first heterophasic propylene copolymer (HPP1).

Alternatively, the first heterophasic propylene copolymer (HPP1) is a propylene homopolymer or a random propylene copolymer or block propylene copolymer having a melt flow rate MFR, (230 °C, 2.16 kg) of from 20.0 to 80.0 g/10 min.

Like the first heterophasic propylene copolymer (HPP1), also the second heterophasic propylene copolymer (HPP2) is a heterophasic system in which the polypropylene homopolymer matrix (PM2) as defined herein constitutes the matrix in which the elastomeric propylene copolymer (AM2) is dispersed.

Accordingly, the second heterophasic propylene copolymer (HPP2) being part of the polypropylene composition (PP) comprises apart from propylene also comonomers. Preferably, the second heterophasic propylene copolymer (HPP2) being part of polypropylene composition (PP) comprises apart from propylene ethylene and/or C₄ to C₁₂ α-olefins. Accordingly, the term second heterophasic propylene copolymer (HPP2) according to this invention is understood as a polypropylene comprising, preferably consisting of, units derivable from (a) propylene

and

(b) ethylene and/or C₄ to C₁₂ α-olefins.

Thus, the second heterophasic propylene copolymer (HPP2) according to this invention, i.e. the second heterophasic propylene copolymer (HPP2) being part of the polypropylene composition (PP), comprises monomers copolymerizable with propylene, for example comonomers such as ethylene and/or C₄ to C₁₂ α-olefins, in particular ethylene and/or C₄ to
C₈ α-olefins, e.g. 1-butene and/or 1-hexene. Preferably, the second heterophasic propylene copolymer (HPP2) according to this invention comprises, especially consists of, monomers copolymerizable with propylene from the group consisting of ethylene, 1-butene and 1-hexene. More specifically, the second heterophasic propylene copolymer (HPP2) of this invention comprises - apart from propylene - units derivable from ethylene and/or 1-butene. In a preferred embodiment, the second heterophasic propylene copolymer (HPP2) according to this invention comprises units derivable from ethylene and propylene only. Still more preferably only the elastomeric propylene copolymer (AM2) contains ethylene comonomers.

It is thus appreciated that the elastomeric propylene copolymer (AM2) dispersed in the polypropylene homopolymer matrix (PM2) comprises propylene monomer units and comonomer units selected from ethylene and/or C₄ to C₁₂ α-olefin. For example, the elastomeric propylene copolymer (AM2) dispersed in the polypropylene homopolymer matrix (PM2) comprises propylene monomer units and ethylene comonomer units.

Accordingly, the elastomeric propylene copolymer (AM2) is preferably an ethylene propylene elastomer, whereas the matrix in which the elastomeric propylene copolymer (AM2) is dispersed is a polypropylene homopolymer matrix (PM2).

It is appreciated that the second heterophasic propylene copolymer (HPP2) being part of the polypropylene composition (PP) preferably has a comonomer content, preferably an ethylene content, of from 3.0 to 8.0 wt.-%, preferably from 3.0 to 7.0 wt.-%, more preferably from 4.0 to 6.0 wt.-% and most preferably from 4.1 to 5.1 wt.-%, based on the total weight of the second heterophasic propylene copolymer (HPP2).

In one embodiment of the present invention, the second heterophasic propylene copolymer (HPP2) has a xylene cold soluble (XCS) fraction (25 °C) of from 9.0 to 20.0 wt.-%, preferably from 10.0 to 15.0 wt.-% and most preferably from 12.0 to 14.0 wt.-%, based on the total weight of the second heterophasic propylene copolymer (HPP2).
Additionally or alternatively, the second heterophasic propylene copolymer (HPP2) being part of the polypropylene composition (PP) has a melt flow rate MFR₂ (230 °C, 2.16 kg) of from 0.05 to 2.0 g/10 min, preferably of from 0.1 to 2.0 g/10 min, more preferably from 0.2 to 1.0 g/10 min and most preferably from 0.2 to 0.5 g/10 min. For example, the second heterophasic propylene copolymer (HPP2) being part of the polypropylene composition (PP) has a melt flow rate MFR₂ (230 °C, 2.16 kg) of from 0.2 to 0.3 g/10 min.

Thus, it is one specific requirement of the present invention that the melt flow rate MFR₂ for the first heterophasic propylene copolymer (HPP1) differs from the melt flow rate MFR₂ (230 °C, 2.16 kg) for the second heterophasic propylene copolymer (FTPP2). In one embodiment of the present invention, the first heterophasic propylene copolymer (HPP1) of the polypropylene composition (PP) has a melt flow rate MFR₂ (230 °C, 2.16 kg) of from 20.0 to 80.0 g/10 min and the second heterophasic propylene copolymer (HPP2) of the polypropylene composition (PP) has a melt flow rate MFR₂ (230 °C, 2.16 kg) of from 0.05 to 2.0 g/10 min. For example, the first heterophasic propylene copolymer (HPP1) of the polypropylene composition (PP) has a melt flow rate MFR₂ (230 °C, 2.16 kg) of from 20.0 to 75.0 g/10 min and the second heterophasic propylene copolymer (HPP2) of the polypropylene composition (PP) has a melt flow rate MFR₂ (230 °C, 2.16 kg) of from 0.2 to 0.5 g/10 min.

The polypropylene homopolymer matrix (PM2) being part of the second heterophasic propylene copolymer (HPP2) is a propylene homopolymer. That is to say, the comonomer content of the polypropylene homopolymer matrix (PM2) is equal or below 0.5 wt.-%, more preferably equal or below 0.3 wt.-% and most preferably not more than 0.1 wt.-%. The weight percentage is based on the total weight of the polypropylene homopolymer matrix (PM2).

In other words, the expression polypropylene homopolymer or polypropylene homopolymer matrix (PM2) as used throughout the instant invention relates to a polypropylene that consists substantially, i.e. of equal or more than 99.5 wt.-%, of propylene units. In a
preferred embodiment, only propylene units in the polypropylene homopolymer are detectable.

Furthermore, it is appreciated that the xylene cold soluble (XCS) fraction of the polypropylene homopolymer matrix (PM2) being part of the second heterophasic propylene copolymer (HPP2) is rather low. Accordingly, the xylene cold soluble (XCS) fraction of the polypropylene homopolymer matrix (PM2) (25 °C) of < 2.0 wt.-%, preferably from 0.1 to 2.0 wt.-% and more preferably from 0.5 to 2.0 wt.-%, based on the total weight of the polypropylene homopolymer matrix (PM2) of the second heterophasic propylene copolymer (HPP2). For example, the xylene cold soluble (XCS) fraction of the polypropylene homopolymer matrix (PM2) (25 °C) is from 1.0 to 2.0 wt.-%, based on the total weight of the polypropylene homopolymer matrix (PM2) of the second heterophasic propylene copolymer (HPP2).

Additionally or alternatively, the polypropylene homopolymer matrix (PM2) being part of the second heterophasic propylene copolymer (HPP2) has also a rather low melt flow rate. Accordingly, it is preferred that the polypropylene homopolymer matrix (PM2) has a melt flow rate MFR₂ (230 °C, 2.16 kg) of from 0.1 to 3.0 g/10 min, preferably from 0.1 to 2.0 g/10 min, more preferably from 0.1 to 1.0 g/10 min and most preferably from 0.1 to 0.5 g/10 min.

A further essential component of the second heterophasic propylene copolymer (HPP2) being part of the polypropylene composition (PP) is the elastomeric propylene copolymer (AM2) dispersed in the polypropylene homopolymer matrix (PM2).

Concerning the comonomers used in the elastomeric propylene copolymer (AM2) it is referred to the information provided for the second heterophasic propylene copolymer (FTPP2). Accordingly, the elastomeric propylene copolymer (AM2) comprises monomers copolymerizable with propylene, for example comonomers such as ethylene and/or C₄ to C₁₂ a-olefins, in particular ethylene and/or C₄ to C₈ a-olefins, e.g. 1-butene and/or 1-hexene. Preferably, the elastomeric propylene copolymer (AM2) comprises, especially consists of,
monomers copolymerizable with propylene from the group consisting of ethylene, 1-butene and 1-hexene. More specifically, the elastomeric propylene copolymer (AM2) comprises - apart from propylene - units derivable from ethylene and/or 1-butene. Thus, in an especially preferred embodiment the elastomeric propylene copolymer (AM2) comprises units derivable from propylene and ethylene only.

According to one embodiment of the present invention, the second heterophasic propylene copolymer (HPP2) being part of the polypropylene composition (PP) comprises an amorphous (AM) phase having an intrinsic viscosity (IV) of from 3.0 to 4.0 dl/g and preferably from 3.5 to 4.0 dl/g.

In one embodiment of the present invention, the comonomer content, more preferably ethylene content, of the amorphous (AM) phase of the second heterophasic propylene copolymer (HPP2) is of from 30.0 to 37.0 wt.-% and preferably from 30.0 to 35.0 wt.-% based on the total weight of the amorphous (AM) phase of the second heterophasic propylene copolymer (HPP2).

As indicated above, it is one requirement of the instant invention that the first heterophasic propylene copolymer (HPP1) and second heterophasic propylene copolymer (HPP2) being part of the polypropylene composition (PP) are provided in a specific amount.

It is appreciated that the instant polypropylene composition (PP) comprises an amount of the first heterophasic propylene copolymer (HPP1) in the range of from 66.6 to 95.2 wt.-%, and an amount of the second heterophasic propylene copolymer (HPP2) is in the range of from 4.8 to 33.4 wt.-%, based on the total weight of the first heterophasic propylene copolymer (HPP1) and of the second heterophasic propylene copolymer (HPP2).

For example, the polypropylene composition (PP) comprises the first heterophasic propylene copolymer (HPP1) in an amount from 70.0 to 95.0 wt.-% and the second heterophasic propylene copolymer (HPP2) in an amount from 5.0 to 30.0 wt.-%, based on the total weight of the first heterophasic propylene copolymer (HPP 1) and of the second heterophasic
propylene copolymer (HPP2). Alternatively, the polypropylene composition (PP) comprises the first heterophasic propylene copolymer (HPP1) in an amount from 80.0 to 95.0 wt.-% and the second heterophasic propylene copolymer (HPP2) in an amount from 5.0 to 20.0 wt.-%, based on the total weight of the first heterophasic propylene copolymer (HPP1) and of the second heterophasic propylene copolymer (HPP2). In one embodiment of the present invention, the polypropylene composition (PP) comprises the first heterophasic propylene copolymer (HPP1) in an amount from 85.0 to 95.0 wt.-%, like from 90.0 to 95.0 wt.-%, and the second heterophasic propylene copolymer (HPP2) in an amount from 5.0 to 15.0 wt.-%, like from 5.0 to 10.0 wt.-%, based on the total weight of the first heterophasic propylene copolymer (HPP1) and of the second heterophasic propylene copolymer (HPP2).

Additionally or alternatively, the weight ratio between the first heterophasic propylene copolymer (HPP1) and the second heterophasic propylene copolymer (HPP2) [(HPP1)/(HPP2)] is in the range of from 20/1 to 2/1, more preferably in the range of from 15/1 to 3/1 and most preferably in the range of from 12/1 to 3/1.

It is appreciated that the instant polypropylene composition (PP) may further comprise typical additives, like acid scavengers, antioxidants, nucleating agents, light stabilizers, slip agents, and/or pigments. Preferably the amount of additives excluding the inorganic filler shall not exceed 7.0 wt.-%, more preferably shall not exceed 5.0 wt.-%, based on the total weight of the polypropylene composition (PP).

In one embodiment of the present invention, the polypropylene composition (PP) comprises the first heterophasic propylene copolymer (HPP1) in an amount of from 40.0 - 60.0 wt.-% and the second heterophasic propylene copolymer (HPP2) in an amount of from 3.0 - 20.0 wt.-%, based on the weight of the polypropylene composition (PP). For example, the polypropylene composition (PP) comprises the first heterophasic propylene copolymer (HPP1) in an amount of from 45.0 - 55.0 wt.-% and the second heterophasic propylene copolymer (HPP2) in an amount of from 3.0 - 15.0 wt.-%, based on the weight of the polypropylene composition (PP).
It is appreciated that the polypropylene composition (PP) of the instant invention may further comprise an elastomeric ethylene copolymer (EE) next to the first heterophasic propylene copolymer (HPP1) and the second heterophasic propylene copolymer (HPP2) to improve the impact properties. It is to be noted that the elastomeric ethylene copolymer (EE) is (chemically) different to the elastomeric propylene copolymer (AMI) of the first heterophasic propylene copolymer (HPP1) and the elastomeric propylene copolymer (AM2) of the second heterophasic propylene copolymer (HPP2) being part of the polypropylene composition (PP).

The elastomeric ethylene copolymer (EE) comprises ethylene units and comonomer units selected from C\textsubscript{4} to C\textsubscript{12} a-olefin, in particular ethylene units and comonomer units selected from C\textsubscript{4} to C\textsubscript{8} a-olefins, e.g. 1-butene and/or 1-hexene and/or 1-octene. Preferably, the elastomeric ethylene copolymer (EE) comprises, especially consists of, ethylene units and comonomer units selected from 1-butene, 1-hexene and 1-octene. More specifically, the elastomeric ethylene copolymer (EE) comprises - apart from ethylene - units derivable from 1-butene and/or 1-octene. Thus, in an especially preferred embodiment the elastomeric ethylene copolymer (EE) comprises units derivable from ethylene and 1-octene only.

The ethylene content within the elastomeric ethylene copolymer (EE) is comparatively high. Accordingly, in a preferred embodiment, the ethylene content of the elastomeric ethylene copolymer (EE) being part of the polypropylene composition (PP) is of at least 50.0 wt.-%, preferably from 50.0 to 75.0 wt.-%, based on the total weight of the elastomeric ethylene copolymer (EE). For example, the ethylene content of the elastomeric ethylene copolymer (EE) being part of the polypropylene composition (PP) is from 60.0 to 70.0 wt.-%, like from 65.0 to 70.0 wt.-%, based on the total weight of the elastomeric ethylene copolymer (EE).

Additionally or alternatively, the elastomeric ethylene copolymer (EE) being part of the polypropylene composition (PP) has a melt flow rate MFR\textsubscript{i} (190 °C, 2.16 kg) of from 0.25 to 30.0 g/10 min, preferably from 0.25 to 20.0 g/10 min, more preferably from 0.25 to 15.0 g/10 min and most preferably from 0.25 to 10.0 g/10 min.
Accordingly, it is appreciated that the elastomeric ethylene copolymer (EE) being part of the polypropylene composition (PP) is preferably an elastomeric ethylene-1-octene copolymer having an ethylene content of at least 50.0 wt.-%, based on the total weight of the elastomeric ethylene copolymer (EE), and a melt flow rate MFRi (190 °C, 2.16 kg) of from 0.25 to 30.0 g/10 min. For example, the elastomeric ethylene copolymer (EE) being part of the polypropylene composition (PP) is an elastomeric ethylene-1-octene copolymer having an ethylene content of from 65.0 to 70.0 wt.-%, based on the total weight of the elastomeric ethylene copolymer (EE), and a melt flow rate MFRi (190 °C, 2.16 kg) of from 0.25 to 10.0 g/10 min.

In one embodiment of the present invention, the polypropylene composition (PP) comprises the elastomeric ethylene copolymer (EE) in an amount of from 5.0 - 20.0 wt.-%, based on the total weight of the polypropylene composition (PP). For example, the polypropylene composition (PP) comprises the elastomeric ethylene copolymer (EE) in an amount of from 5.0 - 15.0 wt.-% or in an amount of from 5.0 - 10.0 wt.-%, based on the total weight of the polypropylene composition (PP).

The polypropylene composition (PP) of the instant invention may also comprise a high density polyethylene (HDPE) next to the first heterophasic propylene copolymer (HPP1), the second heterophasic propylene copolymer (HPP2) and the optional elastomeric ethylene copolymer (EE) in order to improve the anti-scratch properties of the surface of the article molded from the instant polypropylene composition (PP). The high density polyethylene (HDPE) is (chemically) different to the elastomeric propylene copolymer (AMI) of the first heterophasic propylene copolymer (HPP1) and the elastomeric propylene copolymer (AM2) of the second heterophasic propylene copolymer (HPP2) and the optional elastomeric ethylene copolymer (EE) being part of the polypropylene composition (PP).

The high density polyethylene (HDPE) used according to the invention is well known in the art and commercially available.
The high density polyethylene (HDPE) preferably has a melt flow rate MFRi (190 °C, 2.16 kg) of from 0.2 to 15.0 g/10 min, preferably from 0.5 to 10.0 g/10 min, more preferably from 1.0 to 10.0 g/10 min and most preferably from 5.0 to 10.0 g/10 min.

The high density polyethylene (HDPE) typically has a density of at least 930 kg/m³, preferably from 930 to 970 kg/m³ and more preferably from 930 to 950 kg/m³.

In one embodiment of the present invention, the polypropylene composition (PP) comprises the high density polyethylene (HDPE) in an amount of from 5.0 - 10.0 wt.-%, based on the total weight of the polypropylene composition (PP). For example, the polypropylene composition (PP) comprises the high density polyethylene (HDPE) in an amount of from 5 - 8 wt.-%, based on the total weight of the polypropylene composition (PP).

In order to reach the desired level of stiffness, the polypropylene composition (PP) of the invention preferably comprises inorganic filler (F) in a selected amount. Accordingly, the polypropylene composition (PP) according to the present invention preferably comprises inorganic filler (F) in an amount of from 15.0 - 25.0 wt.-%, based on the total weight of the polypropylene composition (PP). In one embodiment of the present invention, the polypropylene composition (PP) according to the present invention preferably comprises inorganic filler in an amount of from 15.0 - 20.0 wt.-%, based on the total weight of the polypropylene composition (PP).

According to one embodiment of the present invention, the inorganic filler (F) is selected from the group consisting of talc, mica, calcium carbonate, diatomaceous, wollastonite and kaolin. For example, the inorganic filler (F) is talc.

In one embodiment of the present invention, the inorganic filler (F) has an average particle size \( d_{50} \) of from 0.65 to 20 \( \mu \text{m} \).

For example, the polypropylene composition (PP) comprises talc as inorganic filler (F). According to one embodiment of the present invention, the inorganic filler, which is used for
the polypropylene composition (PP), is talc having an average particle size $d_{50}$ of from 0.65 to 20 µm.

Thus, a polypropylene composition (PP) of the present invention preferably comprises

5 a) 40.0 - 60.0 wt.-%, based on the total weight of the polypropylene composition (PP), of the first heterophasic propylene copolymer (HPP1),

b) 3.0 - 20.0 wt.-%, based on the total weight of the polypropylene composition (PP), of the second heterophasic propylene copolymer (HPP2),

c) 5.0 - 20.0 wt.-%, based on the total weight of the polypropylene composition (PP), of an elastomeric ethylene copolymer (EE) having a content of ethylene units of at least 50.0 wt.-%, based on the total weight of the elastomeric ethylene copolymer (EE),

d) 5.0 - 10.0 wt.-%, based on the total weight of the polypropylene composition (PP), of a high density polyethylene (HDPE), and

10 e) 15.0 - 25.0 wt.-%, based on the total weight of the polypropylene composition (PP), of an inorganic filler (F).

For example, a polypropylene composition (PP) of the present invention preferably comprises

20 a) 45.0 - 55.0 wt.-%, based on the total weight of the polypropylene composition (PP), of the first heterophasic propylene copolymer (HPP1),

b) 3.0 - 15.0 wt.-%, based on the total weight of the polypropylene composition (PP), of the second heterophasic propylene copolymer (HPP2),

c) 5.0 - 15.0 wt.-%, based on the total weight of the polypropylene composition (PP), of an elastomeric ethylene copolymer (EE) having a content of ethylene units of at least 50.0 wt.-%, based on the total weight of the elastomeric ethylene copolymer (EE),

d) 5.0 - 8.0 wt.-%, based on the total weight of the polypropylene composition (PP), of a high density polyethylene (HDPE), and

30 e) 15.0 - 20.0 wt.-%, based on the total weight of the polypropylene composition (PP), of an inorganic filler (F).
It is appreciated that the instant polypropylene composition (PP) may further comprise at least one typical additives selected from the group consisting of acid scavengers, antioxidants, nucleating agents, light stabilizers, UV-stabilizers, slip agents, antiscratch agents (e.g. organic silicon), dispersing agents and colorants. For example, the polypropylene composition (PP) further comprises additives such as antioxidants, UV-stabilizers, antiscratch agents (e.g. organic silicon), dispersing agents and colorants. Preferably the amount of these additives excluding the inorganic filler (F) shall not exceed 14.0 wt.-%, like not more than 11.0 wt.-%, based on the total weight of the polypropylene composition (PP), within the instant polypropylene composition (PP). In one embodiment of the present invention, the polypropylene composition (PP) comprises antioxidants, UV-stabilizers, antiscratch agents (e.g. organic silicon), dispersing agents and colorants as additives in an amount from 3.0 to 11.0 wt.-% and preferably in an amount from 3.0 to 8.0 wt.-%, based on the total weight of the polypropylene composition (PP).

A preferred antiscratch agent is organic silicon. For example, the polypropylene composition (PP) comprises an antiscratch agent, like organic silicon, in an amount of ≤ 3.0 wt.-%, preferably from 1.0 to 2.0 wt.-% and more preferably in an amount of about 1.0 wt.-%, based on the total weight of the polypropylene composition (PP).

The instant polypropylene composition (PP) contains preferably an α-nucleating agent. Even more preferred the present invention is free of β-nucleating agents. According to the present invention the nucleating agent is understood as a nucleating agent different to the inorganic filler (F). Accordingly, the nucleating agent is preferably selected from the group consisting of

(i) salts of monocarboxylic acids and polycarboxylic acids, e.g. sodium benzoate or aluminum tert-butylbenzoate, and

(ii) dibenzylidenedesorbitol (e.g. 1,3 : 2,4 dibenzylidenedesorbitol) and Ci-Cg-alkyl-substituted dibenzylidenedesorbitol derivatives, such as methyldibenzylidenedesorbitol, ethyldibenzylidenedesorbitol or dimethyldibenzylidenedesorbitol (e.g. 1,3 : 2,4
di(methylbenzylidene) sorbitol), or substituted nonitol-derivatives, such as 1,2,3,-
trideoxy-4,6:5,7-bis-0-[(4-propylphenyl)methylene]-nonitol, and
(iii) salts of diesters of phosphoric acid, e.g. sodium 2,2-methylenebis (4, 6-di-tert-
butylphenyl) phosphate or aluminium-hydroxy-bis[2,2'-methylene-bis(4,6-di-t-
butylphenyl)phosphate], and
(iv) vinylcycloalkane polymer and vinylalkane polymer (as discussed above), and
(v) mixtures thereof.

Such additives are generally commercially available and are described, for example, in

Most preferably the a-nucleating agent is part of the first heterophasic propylene copolymer
(HPP1) and/or the second heterophasic propylene copolymer (HPP2) (and thus of the
polypropylene composition (PP)). Accordingly the a-nucleating agent content of the 

heterophasic propylene copolymer (HPP1) and/or the heterophasic propylene copolymer
(HPP2) (and thus of the polypropylene composition (PP)) is preferably up to 5.0 wt.-%. In a
preferred embodiment, the heterophasic propylene copolymer (HPP1) and/or the
heterophasic propylene copolymer (HPP2) (and thus the polypropylene composition (PP))
contain(s) not more than 3000 ppm, more preferably of 1 to 2000 ppm of a a-nucleating
agent, in particular selected from the group consisting of dibenzylidenesorbitol (e.g. 1.3 : 2,4
dibenzylidene sorbitol), dibenzylidenesorbitol derivative, preferably
dimethylidibenzylidenesorbitol (e.g. 1.3 : 2,4 di(methylbenzylidene) sorbitol), or substituted
nonitol-derivatives, such as 1,2,3,-trideoxy-4,6:5,7-bis-0-[(4-propylphenyl)methylene]-
nonitol, vinylcycloalkane polymer, vinylalkane polymer, and mixtures thereof.

In a preferred embodiment the heterophasic propylene copolymer (HPP1) and/or the
heterophasic propylene copolymer (HPP2) (and thus the polypropylene composition (PP))
contains a vinylcycloalkane, like vinylcyclohexane (VCH), polymer and/or vinylalkane
polymer, as the α-nucleating agent. Preferably in this embodiment the heterophasic
propylene copolymer (HPP1) and the heterophasic propylene copolymer (HPP2) contains a
vinylcycloalkane, like vinylcyclohexane (VCH), polymer and/or vinylalkane polymer,
preferably vinylcyclohexane (VCH). Preferably the vinylcycloalkane is vinylcyclohexane (VCH) polymer which is introduced into the heterophasic propylene copolymer (HPP1) and/or the heterophasic propylene copolymer (HPP2) (and thus into the polypropylene composition (PP)) by the BNT technology. More preferably in this preferred embodiment, the amount of vinylcycloalkane, like vinylcyclohexane (VCH), polymer and/or vinylalkane polymer, more preferably of vinylcyclohexane (VCH) polymer, in the heterophasic propylene copolymer (HPP1) is not more than 500 ppm, more preferably of 1 to 200 ppm, most preferably 5 to 100 ppm, and the amount of vinylcycloalkane, like vinylcyclohexane (VCH), polymer and/or vinylalkane polymer, more preferably of vinylcyclohexane (VCH) polymer, in the heterophasic propylene copolymer (HPP2) is not more than 500 ppm, more preferably of 1 to 200 ppm, most preferably 5 to 100 ppm. Accordingly it is thus preferred that the polypropylene composition (PP) contains not more than 500 ppm, more preferably of 1 to 200 ppm, most preferably 5 to 100 ppm.

With regard to the BNT-technology reference is made to the international applications WO 99/24478, WO 99/24479 and particularly WO 00/68315. According to this technology a catalyst system, preferably a Ziegler-Natta procatalyst, can be modified by polymerising a vinyl compound in the presence of the catalyst system, comprising in particular the special Ziegler-Natta procatalyst, an external donor and a cocatalyst, which vinyl compound has the formula:

\[
\text{CH}_2=\text{CH-CHR}^3\text{R}^4
\]

wherein \(R^3\) and \(R^4\) together form a 5- or 6-membered saturated, unsaturated or aromatic ring or independently represent an alkyl group comprising 1 to 4 carbon atoms, and the modified catalyst is used for the preparation of the heterophasic polypropylene composition according to this invention, i.e. of the heterophasic propylene copolymer (HPP1) and/or the heterophasic propylene copolymer (HPP2), most preferably of the heterophasic propylene copolymer (HPP1) and the heterophasic propylene copolymer (HPP2). The polymerized vinyl compound acts as an a-nucleating agent. The weight ratio of vinyl compound to solid catalyst component in the modification step of the catalyst is preferably of up to 5 (5: 1), preferably up to 3 (3:1) most preferably from 0.5 (1:2) to 2 (2:1). The most preferred vinyl compound is vinylcyclohexane (VCH).
According to another aspect of the present invention, the polypropylene composition (PP) is prepared by blending the first heterophasic propylene copolymer (HPP1) with the second heterophasic propylene copolymer (HPP2), the optional elastomeric ethylene copolymer (EE), the optional high density polyethylene (HDPE), the optional inorganic filler (F) and further optional additives in an extruder, and extruding the obtained blend of the first heterophasic propylene copolymer (HPP1), the second heterophasic propylene copolymer (HPP2) and the optional elastomeric ethylene copolymer (EE), high density polyethylene (HDPE), inorganic filler (F) and further additives in the extruder. The term "blending" refers according to the present invention to the action of providing a blend out of at least two different, pre-existing materials, i.e. the first heterophasic propylene copolymer (HPP1), the second heterophasic propylene copolymer (HPP2) and the optional elastomeric ethylene copolymer (EE), high density polyethylene (HDPE), inorganic filler (F) and further additives.

For blending the individual components of the instant composition, i.e. the first heterophasic propylene copolymer (HPP1) with the second heterophasic propylene copolymer (HPP2) and the optional elastomeric ethylene copolymer (EE), high density polyethylene (HDPE), inorganic filler (F) and further additives, a conventional compounding or blending apparatus, e.g. a Banbury mixer, a 2-roll rubber mill, Buss-co-kneader or a twin screw extruder may be used. The polymer materials recovered from the extruder are usually in the form of pellets. These pellets are then preferably further processed, e.g. by injection moulding to generate articles and products of the inventive composition.

The residence time in the blending apparatus or screw speed of the extruder must be chosen such that a sufficiently high degree of homogenisation is achieved.

All components used for the preparation of the instant polypropylene composition (PP) are known and commercially available. Accordingly, also their preparation is well known. For instance, the first heterophasic propylene copolymer (HPP1) and the second heterophasic propylene copolymer (HPP2) according to this invention are preferably produced independently from each other in a sequential polymerization process, i.e. in a multistage
process known in the art, wherein the corresponding matrices (polypropylene homopolymer matrix (PM1) and polypropylene homopolymer matrix (PM2)) are produced independently from each other at least in one slurry reactor and subsequently the elastomeric copolymers (elastomeric propylene copolymer (AM1) and elastomeric propylene copolymer (AM2)) are produced independently from each other at least in one i.e. one or two, gas phase reactor(s).

More precisely, the first heterophase propylene copolymer (HPP1) is obtained by producing the polypropylene homopolymer matrix (PM1) in at least one reactor system, said system comprises at least one reactor, transferring said polypropylene homopolymer matrix (PM1) in a subsequent reactor system, said system comprises at least one reactor, where in the presence of the polypropylene homopolymer matrix (PM1) the elastomeric propylene copolymer (AM1) is produced.

Additionally or alternatively, the second heterophase propylene copolymer (HPP2) is obtained by producing the polypropylene homopolymer matrix (PM2) in at least one reactor system, said system comprises at least one reactor, transferring said polypropylene homopolymer matrix (PM2) in a subsequent reactor system, said system comprises at least one reactor, where in the presence of the polypropylene homopolymer matrix (PM2) the elastomeric propylene copolymer (AM2) is produced.

Thus, each of the polymerization systems can comprise one or more conventional stirred slurry reactors and/or one or more gas phase reactors. Preferably the reactors used are selected from the group of loop and gas phase reactors and, in particular, the process employs at least one loop reactor and at least one gas phase reactor. It is also possible to use several reactors of each type, e.g. one loop and two or three gas phase reactors, or two loops and one or two gas phase reactors, in series.

Preferably, the process for the preparation of the first heterophase propylene copolymer (HPP1) and/or the second heterophase propylene copolymer (HPP2) comprises also a prepolymerisation with the chosen catalyst system, as described in detail below, comprising the Ziegler-Natta procatalyst, the external donor and the cocatalyst.
In a preferred embodiment, the prepolymerisation is conducted as bulk slurry polymerization in liquid propylene, i.e. the liquid phase mainly comprises propylene, with minor amount of other reactants and optionally inert components dissolved therein.

5 The prepolymerisation reaction is typically conducted at a temperature of 0 to 50 °C, preferably from 10 to 45 °C, and more preferably from 15 to 40 °C.

The pressure in the prepolymerisation reactor is not critical but must be sufficiently high to maintain the reaction mixture in liquid phase. Thus, the pressure may be from 20 to 100 bar, for example 30 to 70 bar.

The catalyst components are preferably all introduced to the prepolymerisation step. However, where the solid catalyst component (i) and the cocatalyst (ii) can be fed separately it is possible that only a part of the cocatalyst is introduced into the prepolymerisation stage and the remaining part into subsequent polymerisation stages. Also in such cases it is necessary to introduce so much cocatalyst into the prepolymerisation stage that a sufficient polymerisation reaction is obtained therein.

15 It is possible to add other components also to the prepolymerisation stage. Thus, hydrogen may be added into the prepolymerisation stage to control the molecular weight of the prepolymer as is known in the art. Further, antistatic additive may be used to prevent the particles from adhering to each other or to the walls of the reactor.

20 The precise control of the prepolymerisation conditions and reaction parameters is within the skill of the art.

25 A slurry reactor designates any reactor, such as a continuous or simple batch stirred tank reactor or loop reactor, operating in bulk or slurry and in which the polymer forms in particulate form. "Bulk" means a polymerization in reaction medium that comprises at least
60.0 wt.-% monomer. According to a preferred embodiment the slurry reactor comprises a bulk loop reactor.

"Gas phase reactor" means any mechanically mixed or fluid bed reactor. Preferably the gas phase reactor comprises a mechanically agitated fluid bed reactor with gas velocities of at least 0.2 m/sec.

The particularly preferred embodiment for the preparation of the first heterophasic propylene copolymer (HPP1) and/or the second heterophasic propylene copolymer (HPP2) of the invention comprises carrying out the polymerization in a process comprising either a combination of one loop and one or two gas phase reactors or a combination of two loops and one or two gas phase reactors.

A preferred multistage process is a slurry-gas phase process, such as developed by Borealis and known as the Borstar® technology. In this respect, reference is made to EP 0 887 379 Al, WO 92/12182, WO 2004/000899, WO 2004/1 11095, WO 99/24478, WO 99/24479 and WO 00/68315. They are incorporated herein by reference.

A further suitable slurry-gas phase process is the Spheripol® process of Basell.

Preferably, the first heterophasic propylene copolymer (HPP1) and/or the second heterophasic propylene copolymer (HPP2) according to this invention are produced by using a special Ziegler-Natta procatalyst in combination with a special external donor, as described below in detail, preferably in the Spheripol® or in the Borstar®-PP process.

One preferred multistage process may therefore comprise the steps of:

- producing a polypropylene matrix in the presence of the chosen catalyst system, as for instance described in detail below, comprising the special Ziegler-Natta procatalyst (i), an external donor (iii) and the cocatalyst (ii) in a first slurry reactor and optionally in a second slurry reactor, both slurry reactors using the same polymerization conditions,
- transferring the slurry reactor product into at least one first gas phase reactor, like one gas phase reactor or a first and a second gas phase reactor connected in series,
- producing an elastomeric copolymer in the presence of the polypropylene matrix and in the presence of the catalyst system in said at least first gas phase reactor,
- recovering the polymer product for further processing.

With respect to the above-mentioned preferred slurry-gas phase process, the following general information can be provided with respect to the process conditions.

The temperature is preferably from 40 to 110 °C, preferably between 50 and 100 °C, in particular between 60 and 90 °C, with a pressure in the range of from 20 to 80 bar, preferably 30 to 60 bar, with the option of adding hydrogen in order to control the molecular weight in a manner known per se.

The reaction product of the slurry polymerization, which preferably is carried out in a loop reactor, is then transferred to the subsequent gas phase reactor(s), wherein the temperature preferably is within the range of from 50 to 130 °C, more preferably 60 to 100 °C, at a pressure in the range of from 5 to 50 bar, preferably 8 to 35 bar, again with the option of adding hydrogen in order to control the molecular weight in a manner known per se.

The average residence time can vary in the reactor zones identified above. In one embodiment, the average residence time in the slurry reactor, for example a loop reactor, is in the range of from 0.5 to 5 hours, for example 0.5 to 2 hours, while the average residence time in the gas phase reactor generally will be from 1 to 8 hours.

If desired, the polymerization may be effected in a known manner under supercritical conditions in the slurry, preferably loop reactor, and/or as a condensed mode in the gas phase reactor.

According to the invention the heterophasic polypropylenes are preferably obtained by a multistage polymerization process, as described above, in the presence of a catalyst system
comprising as component (i) a Ziegler-Natta procatalyst which contains a trans-esterification product of a lower alcohol and a phthalic ester.

The procatalyst used according to the invention is prepared by

a) reacting a spray crystallized or emulsion solidified adduct of MgCl₂ and a C₃-C₅ alcohol with TiCl₄

b) reacting the product of stage a) with a dialkylphthalate of formula (I)

\[
\text{O} \quad \text{O} \\
\text{R¹'} \quad \text{R²'}
\]

wherein R¹ and R² are independently at least a C₃ alkyl

c) washing the product of stage b) or

d) optionally reacting the product of step c) with additional TiCl₄.

The procatalyst is produced as defined for example in the patent applications WO 87/07620, WO 92/19653, WO 92/19658 and EP 0 491 566. The content of these documents is herein included by reference.

First an adduct of MgCl₂ and a C₃-C₅ alcohol of the formula MgCl₂*nROH, wherein R is methyl or ethyl and n is 1 to 6, is formed. Ethanol is preferably used as alcohol.

The adduct, which is first melted and then spray crystallized or emulsion solidified, is used as catalyst carrier.

In the next step the spray crystallized or emulsion solidified adduct of the formula MgCl₂ *nROH, wherein R is methyl or ethyl, preferably ethyl and n is 1 to 6, is contacting with TiCl₄ to form a titanised carrier, followed by the steps of
adding to said titanised carrier

(i) a dialkylphthalate of formula (I) with R$^1$ and R$^2$ being independently at least a C$_5$-alkyl, like at least a C$_g$-alkyl,
or preferably

(ii) a dialkylphthalate of formula (I) with R$^{1'}$ and R$^{2'}$ being the same and being at least a C$_5$-alkyl, like at least a C$_g$-alkyl,
or more preferably

(iii) a dialkylphthalate of formula (I) selected from the group consisting of propylhexylphthalate (PrHP), dioctylphthalate (DOP), di-iso-decylphthalate (DIDP), and ditridecylphthalate (DTDP), yet more preferably the dialkylphthalate of formula (I) is a dioctylphthalate (DOP), like di-iso-octylphthalate or diethylhexylphthalate, in particular diethylhexylphthalate,

10 to form a first product,

• subjecting said first product to suitable transesterification conditions, i.e. to a temperature above 100 °C, preferably between 100 to 150 °C, more preferably between 130 to 150 °C, such that said methanol or ethanol is transesterified with said ester groups of said dialkylphthalate of formula (I) to form preferably at least 80 mol-%, more preferably 90 mol-%, most preferably 95 mol.-%, of a dialkylphthalate of formula (II)

\[
\begin{align*}
\text{(II)} \\
\text{O} & \text{R}^1 \quad \text{O} \\
\text{R}^2 \quad \text{O} \\
\text{O}
\end{align*}
\]

with R$^1$ and R$^2$ being methyl or ethyl, preferably ethyl,

the dialkylphthalat of formula (II) being the internal donor and

• recovering said transesterification product as the procatalyst composition

(component (i)).
The adduct of the formula MgCl\textsubscript{2}\textsuperscript{*}nROH, wherein R is methyl or ethyl and n is 1 to 6, is in a preferred embodiment melted and then the melt is preferably injected by a gas into a cooled solvent or a cooled gas, whereby the adduct is crystallized into a morphologically advantageous form, as for example described in WO 87/07620.

This crystallized adduct is preferably used as the catalyst carrier and reacted to the procatalyst useful in the present invention as described in WO 92/19658 and WO 92/19653.

As the catalyst residue is removed by extracting, an adduct of the titanised carrier and the internal donor is obtained, in which the group deriving from the ester alcohol has changed.

In case sufficient titanium remains on the carrier, it will act as an active element of the procatalyst.

Otherwise the titanization is repeated after the above treatment in order to ensure a sufficient titanium concentration and thus activity.

Preferably the procatalyst used according to the invention contains 2.5 wt.-% of titanium at the most, preferably 2.2% wt.-% at the most and more preferably 2.0 wt.-% at the most. Its donor content is preferably between 4 to 12 wt.-% and more preferably between 6 and 10 wt.-%.

More preferably the procatalyst used according to the invention has been produced by using ethanol as the alcohol and dioctylphthalate (DOP) as dialkylphthalate of formula (I), yielding diethyl phthalate (DEP) as the internal donor compound.

Still more preferably the catalyst used according to the invention is the catalyst as described in the example section; especially with the use of dioctylphthalate as dialkylphthalate of formula (I) according to WO 92/19658.
In a further embodiment, the Ziegler-Natta procatalyst can be modified by polymerising a vinyl compound in the presence of the catalyst system, comprising the special Ziegler-Natta procatalyst, an external donor and a cocatalyst, which vinyl compound has the formula:

$$\text{CH}_2=\text{CHR}^3\text{R}^4$$

wherein $\text{R}^3$ and $\text{R}^4$ together form a 5- or 6-membered saturated, unsaturated or aromatic ring or independently represent an alkyl group comprising 1 to 4 carbon atoms, and the modified catalyst is used for the preparation of the heterophasic polypropylene composition according to this invention. The polymerized vinyl compound can act as an a-nucleating agent. This modification is in particular used for the preparation of the heterophasic polypropylene (H-PP1).

Concerning the modification of catalyst reference is made to the international applications WO 99/24478, WO 99/24479 and particularly WO 00/68315, incorporated herein by reference with respect to the reaction conditions concerning the modification of the catalyst as well as with respect to the polymerization reaction.

For the production of the heterophasic polypropylenes according to the invention, the catalyst system used preferably comprises in addition to the special Ziegler-Natta procatalyst an organometallic cocatalyst as component (ii).

Accordingly it is preferred to select the cocatalyst from the group consisting of trialkylaluminium, like triethylaluminium (TEA), dialkyl aluminium chloride and alkyl aluminium sesquichloride.

Component (iii) of the catalysts system used is an external donor represented by formula (Ilia) or (Illb). Formula (Ilia) is defined by

$$\text{Si(OCH}_3)_2\text{R}^5$$

wherein $\text{R}^5$ represents a branched-alkyl group having 3 to 12 carbon atoms, preferably a branched-alkyl group having 3 to 6 carbon atoms, or a cyclo-alkyl having 4 to 12 carbon atoms, preferably a cyclo-alkyl having 5 to 8 carbon atoms.
It is in particular preferred that \( R^5 \) is selected from the group consisting of iso-propyl, iso-butyl, iso-pentyl, tert.-butyl, tert.-amyl, neopentyl, cyclopentyl, cyclohexyl, methylocyclopentyl and cycloheptyl.

Formula (IIIb) is defined by

\[
\text{Si(OCH}_2\text{CH}_3)_3(\text{NR}^8\text{R}^9) \quad \text{(IIIb)}
\]

wherein \( R^8 \) and \( R^9 \) can be the same or different and represent a hydrocarbon group having 1 to 12 carbon atoms.

\( R^8 \) and \( R^9 \) are independently selected from the group consisting of linear aliphatic hydrocarbon group having 1 to 12 carbon atoms, branched aliphatic hydrocarbon group having 1 to 12 carbon atoms and cyclic aliphatic hydrocarbon group having 1 to 12 carbon atoms. It is in particular preferred that \( R^8 \) and \( R^9 \) are independently selected from the group consisting of methyl, ethyl, n-propyl, n-butyl, octyl, decanyl, iso-propyl, iso-butyl, iso-pentyl, tert.-butyl, tert.-amyl, neopentyl, cyclopentyl, cyclohexyl, methylocyclopentyl and cycloheptyl.

More preferably both \( R^8 \) and \( R^9 \) are the same, yet more preferably both \( R^8 \) and \( R^9 \) are an ethyl group.

More preferably the external donor of formula (IIIb) is diethylaminotriethoxysilane.

Most preferably the external donor is of formula (IIia), like dicyclopentyl dimethoxy silane \([\text{Si(OCH}_3)_2(\text{cyclo-pentyl})_2]\) or diisopropyl dimethoxy silane \([\text{Si(OCH}_3)_2(\text{CH(CH}_3)_2)_2]\).

The polypropylene compositions of the present invention are suitable for a wide range of applications. In particular, it is appreciated that the instant polypropylene composition maintains mechanical properties, such as excellent balanced stiffness/impact behavior, while exhibiting no tiger stripes.
In view of the very good results obtained with regard to the instant polypropylene composition (PP), said polypropylene composition (PP) is particularly suitable for the preparation of molded articles. Thus, another aspect of the present invention is directed to an article comprising the polypropylene composition (PP) as defined above.

For example, the article comprises the polypropylene composition (PP) in an amount of at least 60.0 wt.-%, more preferably at least 80.0 wt.-% and most preferably at least 95.0 wt.-%, based on the total weight of the article. In one embodiment of the present invention, the article consists of the instant polypropylene composition (PP).

It is preferred that the article is a moulded article, preferably an injection moulded article. Preferred examples of such injection moulded articles are large parts for applications in the automotive or household industry. For example, the present invention is directed to automotive articles, especially to car interiors and exteriors, like bumpers, body panels, spoilers, dashboards and/or door panels.

Accordingly the present invention is especially directed to automotive articles, especially to car interiors and exteriors, like bumpers, body panels, spoilers, dashboards, door panels and the like, in particular bumpers and/or door panels, comprising at least 60.0 wt.-%, more preferably at least 80.0 wt.-%, yet more preferably at least 95.0 wt.-%, like consisting, of the instant polypropylene composition (PP).

Accordingly, a further aspect of the invention is directed to the use of the polypropylene composition (PP) as defined above for the preparation of a moulded article. It is preferred that the polypropylene composition (PP) as defined above is used for the preparation of an injection moulded article.

A still further aspect of the invention is the use of the polypropylene composition (PP) as defined above for reducing tiger stripes on the surface of an article comprising, preferably consisting of, the instant polypropylene composition (PP).
The present invention will now be described in further detail by the examples provided below.

**EXAMPLES**

5

The following definitions of terms and determination methods apply for the above general description of the invention as well as to the below examples unless otherwise defined.

A. **Definitions/Measuring Methods**

The following definitions of terms and determination methods apply for the above general description of the invention as well as to the below examples unless otherwise defined.


- **Average particle size d50 (Laser diffraction)** is calculated from the particle size distribution [mass percent] as determined by laser diffraction (Mastersizer) according to ISO 13320-1.

- **MFR**
  - **MFR2** (230 °C) is measured according to ISO 1133 (230 °C, 2.16 kg load).
  - **MFR1** (190 °C) is measured according to ISO 1133 (190 °C, 2.16 kg load).

- **The xylene cold solubles (XCS, wt.-%)**: Content of xylene cold solubles (XCS) is determined at 23 °C according ISO 6427.

- **The amorphous content (AM)** is measured by separating the above xylene cold soluble fraction (XCS) and precipitating the amorphous part with acetone. The precipitate was filtered and dried in a vacuum oven at 90 °C.

  \[ \text{AM\%} = \frac{100 \times m_1 \times v_0}{m_0 \times v_i} \]

  wherein

  - "AM\%" is the amorphous fraction,
  - "m_0" is initial polymer amount (g)
  - "m_1" is weight of precipitate (g)
  - "v_0" is initial volume (ml)
  - "v_i" is volume of analyzed sample (ml)

- **Intrinsic viscosity** is measured according to DIN ISO 628/1, October 1999 (in Decalin at 135 °C).
**Tensile strength; Tensile strain at break (or Elongation at break)** are measured according to ISO 527-2 (cross head speed = 50 mm/min; 23 °C) using injection molded specimens as described in EN ISO 1873-2 (dog bone shape, 4 mm thickness).

**Flexural Modulus** is determined in 3-point-bending according to ISO 178 on injection molded specimens of 80 x 10 x 4 mm prepared in accordance with ISO 294-1 : 1996.

**Izod notched impact strength** is determined according to ISO 180 / 1A at 23 °C by using injection moulded test specimens as described in EN ISO 1873-2 (80 x 10 x 4 mm) of 80 x 10 x 4 mm prepared in accordance with ISO 294-1: 1996.

**Comonomer content**, especially ethylene content is measured with Fourier transform infrared spectroscopy (FTIR) calibrated with $^{13}$C-NMR. When measuring the ethylene content in polypropylene, a thin film of the sample (thickness about 250 μm) was prepared by hot-pressing. The area of absorption peaks 720 and 733 cm$^{-1}$ for propylene-ethylene-copolymers was measured with Perkin Elmer FTIR 1600 spectrometer. Propylene-1-butene-copolymers were evaluated at 767 cm$^{-1}$. The method was calibrated by ethylene content data measured by $^{13}$C-NMR. See also "IR-Spektroskopie fur Anwender"; WILEY-VCH, 1997 and "Validierung in der Analytik", WILEY-VCH, 1997

**Tiger stripes**: The tendency to show tiger stripes is evaluated visually on a black sheet having a size of 356 (L) x 70 (W) x 2 (T) mm prepared by injection molding the extruded compound by using an injection-molding machinery at an injection speed of 30 mm/s. The tiger stripes on the surface of the black sheet are determined by naked eyes under a light source of a 40 W fluorescent lamp. "Eliminated" refers to sheets without any tiger stripes over the entire sheet surface under the test conditions. "Conspicuous" means that tiger stripes appear on the surface of test sheet under the test conditions. "Unconspicuous" means occurrence of light tiger stripes but not conspicuous on the surface of test sheet under the test condition.
B. Examples

Polymers (HPPla), (HPPlb), (HPPlc), (HPPld) and (HPP2) were produced in a Borstar pilot plant with a prepolymerization reactor, one slurry loop reactor and two gas phase reactors. In the loop reactor and the first gas phase reactor, the matrix has been produced, whereas in the second gas phase reactor, the elastomeric phase is produced.

The catalyst used in the polymerization process has been produced as follows: First, 0.1 mol of MgC\(^{3}\) EtOH was suspended under inert conditions in 250 ml of decane in a reactor at atmospheric pressure. The solution was cooled to the temperature of -15°C and 300 ml of cold TiCl\(_{4}\) was added while maintaining the temperature at said level. Then, the temperature of the slurry was increased slowly to 20 °C. At this temperature, 0.02 mol of dioctylphthalate (DOP) was added to the slurry. After the addition of the phthalate, the temperature was raised to 135 °C during 90 minutes and the slurry was allowed to stand for 60 minutes. Then, another 300 ml of TiCl\(_{4}\) was added and the temperature was kept at 135 °C for 120 minutes.

After this, the catalyst was filtered from the liquid and washed six times with 300 ml heptane at 80 °C. Then, the solid catalyst component was filtered and dried. Catalyst and its preparation concept is described in general e.g. in patent publications EP491566, EP591224 and EP5 86390. As co-catalyst triethyl-aluminium (TEAL) and as donor dicyclo pentyl dimethoxy silane (D-donor) was used. The aluminium to donor ratio is indicated in table 1.

Before the polymerization, the catalyst was prepolymerized with vinyl cyclohexane in an amount to achieve a concentration of 200 ppm poly(vinyl cyclohexane) (PVCH) in the final polymer. The respective process is described in EP 1028 984 and EP 183 307.
Table 1: Properties of polymer (HPP1a), (HPP1b), (HPP1c), (HPP1d) and (HPP2)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>unit</th>
<th>HPP1a</th>
<th>HPP1b</th>
<th>HPP1c</th>
<th>HPP1d</th>
<th>HPP2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Donor type</td>
<td></td>
<td>D</td>
<td>D</td>
<td>D</td>
<td>D</td>
<td>D</td>
</tr>
<tr>
<td>TEAL/donor ratio</td>
<td>[mol/mol]</td>
<td>15</td>
<td>15</td>
<td>15</td>
<td>15</td>
<td>15</td>
</tr>
<tr>
<td>Matrix</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MFR₂</td>
<td>[g/10min]</td>
<td>100</td>
<td>40</td>
<td>240</td>
<td>160</td>
<td>0.3</td>
</tr>
<tr>
<td>XCS</td>
<td>[wt.-%]</td>
<td>2</td>
<td>1.4</td>
<td>2</td>
<td>1.0</td>
<td>1.5</td>
</tr>
<tr>
<td>Final Properties</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MFR₂</td>
<td>[g/10min]</td>
<td>38</td>
<td>20</td>
<td>50</td>
<td>70</td>
<td>0.25</td>
</tr>
<tr>
<td>AM</td>
<td>[wt.-%]</td>
<td>18</td>
<td>16.5</td>
<td>21</td>
<td>18</td>
<td>12</td>
</tr>
<tr>
<td>XCS</td>
<td>[wt.-%]</td>
<td>19</td>
<td>17.5</td>
<td>23</td>
<td>20</td>
<td>13</td>
</tr>
<tr>
<td>IV of AM</td>
<td>[dl/g]</td>
<td>2.3</td>
<td>2.6</td>
<td>2.7</td>
<td>2.2</td>
<td>3.5</td>
</tr>
<tr>
<td>C2 total</td>
<td>[wt.-%]</td>
<td>8.0</td>
<td>7.5</td>
<td>10</td>
<td>8.5</td>
<td>4.6</td>
</tr>
<tr>
<td>C2 of AM</td>
<td>[wt.-%]</td>
<td>35</td>
<td>34</td>
<td>33</td>
<td>36</td>
<td>33</td>
</tr>
</tbody>
</table>

The compositions of Inventive Examples 1 to 10 are prepared by using a Coperion STS-35 twin-screw extruder based on recipe as summarized in Table 2.

Table 2: Composition recipe for inventive Examples 1 to 10:

<table>
<thead>
<tr>
<th>Ingredient</th>
<th>IE1</th>
<th>IE2</th>
<th>IE3</th>
<th>IE4</th>
<th>IE5</th>
<th>IE6</th>
<th>IE7</th>
<th>IE8</th>
<th>IE9</th>
<th>IE10</th>
</tr>
</thead>
<tbody>
<tr>
<td>HPP1a</td>
<td>51</td>
<td>55</td>
<td>90</td>
<td>80</td>
<td>57</td>
<td>55</td>
<td>42</td>
<td>--</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>HPP1b</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>55</td>
<td>--</td>
</tr>
<tr>
<td>HPP1c</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>55</td>
</tr>
<tr>
<td>HPP1d</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>55</td>
</tr>
<tr>
<td>HPP2</td>
<td>5</td>
<td>5</td>
<td>10</td>
<td>20</td>
<td>3</td>
<td>10</td>
<td>16</td>
<td>5</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>EE</td>
<td>10</td>
<td>10</td>
<td>0</td>
<td>0</td>
<td>10</td>
<td>5</td>
<td>5</td>
<td>10</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>HDPE</td>
<td>5</td>
<td>5</td>
<td>0</td>
<td>0</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
</tr>
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<td>16</td>
<td>16</td>
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<tr>
<td>P</td>
<td>4</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>4</td>
<td>3.8</td>
<td>4</td>
<td>4.4</td>
<td>4</td>
</tr>
<tr>
<td>AC</td>
<td>1.4</td>
<td>1.5</td>
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<td>0</td>
<td>1.4</td>
<td>1.6</td>
<td>1.9</td>
<td>1.0</td>
<td>1.4</td>
<td></td>
</tr>
</tbody>
</table>

* rest to 100 wt.-% are typical additives, like antioxidants and UV light stabilizer

EE: is the commercial product "POE 8150" of Dow Chemical Company (Shanghai, China). It is an elastomeric copolymer of ethylene and octene, having an ethylene content of 61 wt.-%, MFR, (190 °C, 2.16 kg) of 0.5g/10min, and a density of 0.868g/cm³.
HDPE is the commercial polyethylene product "HD5070EA" available from Panjin Petrochem. Co. (Panjin, Liaoning, China) having a density of 0.95g/cm$^3$ and a MFR$_1$ (190 °C, 2.16 kg) of 7.5g/10min.

F: is the commercially available talc "HTP Ultra 5" of IMI Fabi China, having a d$_{30}$ of 0.65 µm.

P: is the commercially available pigment "CMBO99-Black 9557" of Shanghai Yuchengcanxing Plastic Material Ltd. (Shanghai, China).

AC: is the commercially available polypropylene powder "HCOOIBl-Bl" of Borealis AG having a MFR$_2$ (230 °C, 2.16 kg) of 2.5 g/lOmin.

For the preparation of inventive examples comprising the polypropylene composition of the present invention, a Coperion STS-35 twin-screw extruder (available from Coperion (Nanjing) Corporation, China) is used with a diameter of 35 mm. The twin screw extruder runs at an average rotation rate of 400 rpm with a temperature profile of zones from 190-235 °C. It has a L/D of 44. The temperature of each zone, throughput and the screw speed of the extruder for preparing the compositions of inventive examples are listed in Table 3.

Table 3: Extruder parameters for inventive Examples 1 to 10:

<table>
<thead>
<tr>
<th>TZ</th>
<th>TE1</th>
<th>TE2</th>
<th>TE3</th>
<th>TE4</th>
<th>TE5</th>
<th>TE6</th>
<th>TE7</th>
<th>TE8</th>
<th>TE9</th>
<th>TE10</th>
</tr>
</thead>
<tbody>
<tr>
<td>TZ1</td>
<td>220</td>
<td>220</td>
<td>210</td>
<td>220</td>
<td>223</td>
<td>228</td>
<td>230</td>
<td>230</td>
<td>220</td>
<td>215</td>
</tr>
<tr>
<td>TZ2</td>
<td>225</td>
<td>225</td>
<td>215</td>
<td>225</td>
<td>225</td>
<td>225</td>
<td>225</td>
<td>230</td>
<td>220</td>
<td>215</td>
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<tr>
<td>TZ3</td>
<td>220</td>
<td>220</td>
<td>210</td>
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<td>210</td>
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</tr>
<tr>
<td>TZ4</td>
<td>220</td>
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<td>210</td>
<td>225</td>
<td>220</td>
<td>222</td>
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<td>221</td>
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</tr>
<tr>
<td>TZ5</td>
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<td>190</td>
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<tr>
<td>TZ8</td>
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<td>-0.01</td>
<td>-0.01</td>
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<td>-0.01</td>
</tr>
</tbody>
</table>

TZ: temperature of zone
The temperature of each zone, throughput and screw speed of the extruder are initiative parameters, and are set on control panel of the extruder. Melt temperature (temperature of the melt in the die) and torque of the extruder are passive parameters shown on control panel of the extruder. A vacuum bump is located in zone 9 and generates a vacuum of -0.01 MPa inside the extruder.

AC is used as a carrier and dispersant for the further additives (anti-scratch agent, antioxidants and UV light stabilizer). AC and the further additives are premixed, and then the mixture obtained is fed into the extruder through feeder 1 located in zone 1 of the extruder together with HPPla/HPPlb/HPPlc/HPPld, HPP2, EE, HDPE and P. F is fed into the extruder through a side feeder located in zone 3 of the extruder. The content of the extruder is heated and mixed through zones 1-11 of the extruder, and is granulated through a die head of the extruder.

For the preparation of regular molded specimens used for measuring mechanical properties such as tensile property, flexural property, and impact property (like Izod Notched, 23 °C), and of molded sheets for measuring the "tiger-stripes", an injection-molding machine, Victory 120 available from Engel Machinery (Shanghai) Ltd, is used. The injection-molding machine includes a single-screw plasticizing part and an injection part. The single-screw plasticizing part includes 3 heating zones. The injection part includes a nozzle and a mold.

For preparing regular test samples for the measurement of the mechanical properties, the mold is a regular one having an inner hollow cavity in dog-bone shape or oblong shape with a small "V" notch at one side edge, as required and indicated in the test method mentioned above.

The pellets of each composition IE1 to IE10 obtained from the extruder as mentioned above are fed into the injection-molding machine. The pellets are heated, molten and mixed in the 3
heating zones, and then injected through the nozzle into the mold to form the test samples in "dog-bone" shape or oblong shape with a "V" notch for measuring mechanical properties. The above mentioned injection-molding machine is also used to prepare molded sample sheets for measuring "tiger stripe", but the mold is replaced with a mold suitable for preparing an oblong sheet of the dimensions 356(L)mmx70(W)mm>2 (T)mm. The dimensions and shape of the inner hollow cavity of the mold correspond enantiomorphously to the sheets for testing "tiger stripe". The pellets of the composition of each example obtained in the extruder as mentioned above are fed into the injection-molding machine. The pellets are heated, molten and mixed in the 3 heating zones, and then injected through the nozzle into the hollow cavity of the mold in order to obtain the sheet for testing "tiger stripe". The processing parameters for injection-molding the molded specimen in order to measure mechanical properties for each inventive example are listed in Table 4.

**Table 4:** Molding process parameters of the specimen for measuring mechanical properties

<table>
<thead>
<tr>
<th>Temperature profile</th>
<th>IE1</th>
<th>IE2</th>
<th>IE3</th>
<th>IE4</th>
<th>IE5</th>
<th>IE6</th>
<th>IE7</th>
<th>IE8</th>
<th>IE9</th>
<th>IE10</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zone 1 [°C]</td>
<td>230</td>
<td>220</td>
<td>220</td>
<td>220</td>
<td>220</td>
<td>220</td>
<td>235</td>
<td>220</td>
<td>220</td>
<td>220</td>
</tr>
<tr>
<td>Zone 2 [°C]</td>
<td>230</td>
<td>220</td>
<td>215</td>
<td>225</td>
<td>225</td>
<td>220</td>
<td>225</td>
<td>230</td>
<td>220</td>
<td>230</td>
</tr>
<tr>
<td>Nozzle [°C]</td>
<td>225</td>
<td>225</td>
<td>225</td>
<td>225</td>
<td>220</td>
<td>230</td>
<td>220</td>
<td>220</td>
<td>220</td>
<td>220</td>
</tr>
<tr>
<td>Injecting Speed [mm/s]</td>
<td>12</td>
<td>12</td>
<td>12</td>
<td>12</td>
<td>12</td>
<td>12</td>
<td>12</td>
<td>12</td>
<td>12</td>
<td>12</td>
</tr>
<tr>
<td>Holding time in the mold [s]</td>
<td>8</td>
<td>8</td>
<td>8</td>
<td>8</td>
<td>8</td>
<td>8</td>
<td>8</td>
<td>8</td>
<td>8</td>
<td>8</td>
</tr>
<tr>
<td>Cooling time [s]</td>
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<td>20</td>
<td>20</td>
<td>20</td>
<td>20</td>
<td>20</td>
<td>20</td>
<td>20</td>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td>Holding pressure in the mold [bar]</td>
<td>50</td>
<td>50</td>
<td>50</td>
<td>50</td>
<td>50</td>
<td>50</td>
<td>50</td>
<td>50</td>
<td>50</td>
<td>50</td>
</tr>
<tr>
<td>Back pressure in plasticizing part [bar]</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
</tr>
</tbody>
</table>

The processing parameters for injection-molding the sheet in order to measure "tiger stripes" for each inventive example are listed in Table 5.
The mechanical properties of the molded specimen and "tiger stripes" of the molded sheets are measured according to the methods as mentioned above, and shown in Table 6. The mechanical and optical property (tiger stripe) profiles of prior art formulations Comparison Example 1 (CE1) and Comparison Example 2 (CE2) are also summarized in Table 6 (6a-6b). Mechanical and optical properties of the prior products (CE1 and CE2) are also tested according to the same methods as used for inventive examples 1 to 10.

### Table 5: Molding conditions of the sheet for testing tiger stripes

<table>
<thead>
<tr>
<th>Temperature profile</th>
<th>IE1</th>
<th>IE2</th>
<th>IE3</th>
<th>IE4</th>
<th>IE5</th>
<th>IE6</th>
<th>IE7</th>
<th>IE8</th>
<th>IE9</th>
<th>IE10</th>
</tr>
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<tbody>
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<td>210</td>
<td>210</td>
<td>220</td>
<td>220</td>
<td>235</td>
<td>220</td>
<td>235</td>
<td>235</td>
<td>235</td>
</tr>
<tr>
<td>Zone 2 [°C]</td>
<td>230</td>
<td>210</td>
<td>215</td>
<td>225</td>
<td>225</td>
<td>225</td>
<td>230</td>
<td>230</td>
<td>230</td>
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<td>Zone 3 [°C]</td>
<td>220</td>
<td>205</td>
<td>205</td>
<td>220</td>
<td>220</td>
<td>220</td>
<td>220</td>
<td>220</td>
<td>220</td>
<td>220</td>
</tr>
<tr>
<td>Injecting Speed [mm/s]</td>
<td>30</td>
<td>30</td>
<td>30</td>
<td>30</td>
<td>30</td>
<td>30</td>
<td>30</td>
<td>30</td>
<td>30</td>
<td>30</td>
</tr>
<tr>
<td>Holding time in the mold [s]</td>
<td>15</td>
<td>15</td>
<td>15</td>
<td>15</td>
<td>15</td>
<td>15</td>
<td>15</td>
<td>15</td>
<td>15</td>
<td>15</td>
</tr>
<tr>
<td>Holding pressure in the mold [bar]</td>
<td>60</td>
<td>60</td>
<td>60</td>
<td>60</td>
<td>60</td>
<td>60</td>
<td>60</td>
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</tr>
<tr>
<td>Back pressure in plasticizing part [bar]</td>
<td>8</td>
<td>8</td>
<td>8</td>
<td>8</td>
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<td>8</td>
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<td>8</td>
</tr>
</tbody>
</table>

The mechanical properties of the molded specimen and "tiger stripes" of the molded sheets are measured according to the methods as mentioned above, and shown in Table 6. The mechanical and optical property (tiger stripe) profiles of prior art formulations Comparison Example 1 (CE1) and Comparison Example 2 (CE2) are also summarized in Table 6 (6a-6b). Mechanical and optical properties of the prior products (CE1 and CE2) are also tested according to the same methods as used for inventive examples 1 to 10.

### Table 6a: Properties of the inventive Examples

<table>
<thead>
<tr>
<th>Property</th>
<th>Unit</th>
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<th>IE2</th>
<th>IE3</th>
<th>IE4</th>
<th>IE5</th>
</tr>
</thead>
<tbody>
<tr>
<td>MFR (230 °C, 2.16 kg)</td>
<td>[g/10min]</td>
<td>12</td>
<td>13</td>
<td>22</td>
<td>13</td>
<td>15</td>
</tr>
<tr>
<td>Flexural Modulus</td>
<td>[MPa]</td>
<td>1750</td>
<td>1720</td>
<td>1700</td>
<td>1730</td>
<td>1700</td>
</tr>
<tr>
<td>Tensile Strength</td>
<td>[MPa]</td>
<td>19</td>
<td>19</td>
<td>28</td>
<td>29</td>
<td>19</td>
</tr>
<tr>
<td>Izod notched +23 °C</td>
<td>[kJ/m²]</td>
<td>48</td>
<td>48</td>
<td>6</td>
<td>7</td>
<td>50</td>
</tr>
<tr>
<td>Tiger stripes</td>
<td>[-]</td>
<td>E</td>
<td>E</td>
<td>E</td>
<td>E</td>
<td>E</td>
</tr>
</tbody>
</table>

### Table 6b: Properties of the inventive and comparative examples

<table>
<thead>
<tr>
<th>Property</th>
<th>Unit</th>
<th>IE6</th>
<th>IE7</th>
<th>IE8</th>
<th>IE9</th>
<th>IE10</th>
<th>CE1</th>
<th>CE2</th>
</tr>
</thead>
<tbody>
<tr>
<td>MFR (230 °C, 2.16 kg)</td>
<td>[g/10min]</td>
<td>11</td>
<td>9</td>
<td>8.8</td>
<td>18</td>
<td>25</td>
<td>13</td>
<td>18</td>
</tr>
<tr>
<td>Flexural Modulus</td>
<td>[MPa]</td>
<td>2000</td>
<td>2450</td>
<td>1780</td>
<td>1520</td>
<td>1730</td>
<td>1700</td>
<td>1720</td>
</tr>
<tr>
<td>Tensile Strength</td>
<td>[MPa]</td>
<td>21</td>
<td>20</td>
<td>20</td>
<td>20</td>
<td>18</td>
<td>18</td>
<td>18</td>
</tr>
<tr>
<td>Izod notched +23 °C</td>
<td>[kJ/m²]</td>
<td>45</td>
<td>22</td>
<td>45</td>
<td>36</td>
<td>32</td>
<td>30</td>
<td>25</td>
</tr>
<tr>
<td>Tiger stripes</td>
<td>[-]</td>
<td>E</td>
<td>E</td>
<td>E</td>
<td>E</td>
<td>C</td>
<td>UC</td>
<td></td>
</tr>
</tbody>
</table>
CE1 is a commercial product, comprising 67 wt.-% heterophasic propylene copolymer, 8 wt.-% HDPE, and 20 wt.-% talc, and balanced additives, the heterophasic propylene copolymer having a MFR$_2$ (230 °C, 2.16 kg) of 18 g/10min, 20% ethylene content, 30 wt.-% XCS, 29 wt.-% AM, AM of heterophasic propylene copolymer having 69 wt.-% ethylene content.

CE2 is the commercial product "C3322T-2" of Pret Composites Co.Ltd (Shanghai, China), comprising a polypropylene with a MFR$_2$ (230 °C, 2.16 kg) above 60 g/10min, C2-C8 elastomer copolymer, HDPE, talc, and balanced additives.

It can be seen from Table 6a and 6b that the occurrence of tiger stripes has been eliminated for the inventive examples in comparison to comparative examples CE1 and CE2.

Furthermore, the inventive examples with EE, HDPE and F show an excellent balance of mechanical properties, like notched impact strength, stiffness as well as tensile strength, which are retained, or even better in comparison to comparative examples CE1 and CE2 containing similar components.
CLAIMS

1. Polypropylene composition (PP) comprising
   a) a first heterophasic propylene copolymer (HPP1) having a melt flow rate $MFR_2$
      (230 °C, 2.16 kg) measured according to ISO 1133 of from 20.0 to 80.0 g/10 min, and
   b) a second heterophasic propylene copolymer (HPP2) having a melt flow rate $MFR_2$
      (230 °C, 2.16 kg) measured according to ISO 1133 of from 0.05 to 2.0 g/10 min,
   wherein
   i) the amount of the first heterophasic propylene copolymer (HPP1) is in the range of
      from 66.6 to 95.2 wt.-%, based on the total weight of the first heterophasic propylene
      copolymer (HPP1) and of the second heterophasic propylene copolymer (HPP2), and
   ii) the amount of the second heterophasic propylene copolymer (HPP2) is in the range
      of from 4.8 to 33.4 wt.-%, based on the total weight of the first heterophasic
      propylene copolymer (HPP1) and of the second heterophasic propylene copolymer
      (HPP2).

2. Polypropylene composition (PP) according to claim 1, wherein the first heterophasic
   propylene copolymer (HPP1) has
   a) a melt flow rate $MFR_2$ (230 °C, 2.16 kg) measured according to ISO 1133 of from
      20.0 to 75.0 g/10 min, and/or
   b) a xylene cold soluble (XCS) fraction measured according to ISO 16152 (25 °C) of
      from 15.0 to 25.0 wt.-%, based on the total weight of the first heterophasic
      propylene copolymer (HPP1), and/or
   c) an ethylene content of < 15.0 wt.-%, based on the total weight of the first
      heterophasic propylene copolymer (HPP1), and/or
   d) an amorphous (AM) phase having an intrinsic viscosity (IV) of from 2.0 to 3.0 dl/g,
      and/or
   e) an amorphous (AM) phase having an ethylene content of 33.0 to 40.0 wt.-%, based
      on the total weight of the amorphous (AM) phase of the first heterophasic propylene
      copolymer (HPP1).
3. Polypropylene composition (PP) according to claim 1 or 2, wherein the second heterophasic propylene copolymer (HPP2) has
   a) a melt flow rate MFR₂ (230 °C, 2.16 kg) measured according to ISO 1133 of from 0.1 to 2.0 g/10 min, and/or
   b) a xylene cold soluble (XCS) fraction measured according to ISO 16152 (25 °C) of from 9.0 to 20.0 wt.-%, based on the total weight of the second heterophasic propylene copolymer (HPP2), and/or
   c) an ethylene content of from 3.0 to 8.0 wt.-%, based on the total weight of the second heterophasic propylene copolymer (HPP2), and/or
   d) an amorphous (AM) phase having an intrinsic viscosity (IV) of from 3.0 to 4.0 dl/g, and/or
   e) an amorphous (AM) phase having an ethylene content of 30.0 to 37.0 wt-%, based on the total weight of the amorphous (AM) fraction of the second heterophasic propylene copolymer (HPP2).

4. Polypropylene composition (PP) according to any one of the preceding claims, wherein the first heterophasic propylene copolymer (HPP1) comprises a polypropylene homopolymer matrix (PM1) and an elastomeric propylene copolymer (AMI) dispersed in said matrix (PM1) and/or the second heterophasic propylene copolymer (HPP2) comprises a polypropylene homopolymer matrix (PM2) and an elastomeric propylene copolymer (AM2) dispersed in said matrix (PM2).

5. Polypropylene composition (PP) according to claim 4, wherein the polypropylene homopolymer matrix (PM1) of the first heterophasic propylene copolymer (HPP1) has
   a) a melt flow rate MFR₂ (230 °C, 2.16 kg) measured according to ISO 1133 of from 30.0 to 250.0 g/10 min, and/or
   b) a xylene cold soluble (XCS) fraction measured according to ISO 16152 (25 °C) of from 0.8 to 3.0 wt.-%, based on the total weight of the polypropylene homopolymer matrix (PM1) of the first heterophasic propylene copolymer (HPP1).
6. Polypropylene composition (PP) according to claim 3 or 4, wherein the polypropylene homopolymer matrix (PM2) of the second heterophasic propylene copolymer (HPP2) has
   a) a melt flow rate \(MFR_2\) (230 °C, 2.16 kg) measured according to ISO 1133 of from 0.1 to 3.0 g/10 min, and/or
   b) a xylene cold soluble (XCS) fraction measured according to ISO 16152 (25 °C) of < 2.0 wt.-%, based on the total weight of the polypropylene homopolymer matrix (PM2) of the second heterophasic propylene copolymer (HPP2).

7. Polypropylene composition (PP) according to any one of the preceding claims, wherein the polypropylene composition (PP) comprises
   a) 40.0 - 60.0 wt.-%, based on the total weight of the polypropylene composition (PP), of the first heterophasic propylene copolymer (HPP1),
   b) 3.0 - 20.0 wt.-%, based on the total weight of the polypropylene composition (PP), of the second heterophasic propylene copolymer (HPP2),
   c) 5.0 - 20.0 wt.-%, based on the total weight of the polypropylene composition (PP), of an elastomeric ethylene copolymer (EE) having a content of ethylene units of at least 50.0 wt.-%, based on the total weight of the elastomeric ethylene copolymer (EE),
   d) 5.0 - 10.0 wt.-%, based on the total weight of the polypropylene composition (PP), of a high density polyethylene (HDPE), and
   e) 15.0 - 25.0 wt.-%, based on the total weight of the polypropylene composition (PP), of an inorganic filler (F).

8. Polypropylene composition (PP) according to claim 7, wherein the elastomeric ethylene copolymer (EE)
   a) comprises ethylene units and comonomer units selected from \(C_4\) to \(C_{12}\) a-olefin, and/or
   b) has a content of ethylene units of from 50.0 to 75.0 wt.-%, based on the total weight of the elastomeric ethylene copolymer (EE), and/or
c) has a melt flow rate $\text{MFR}_i$ (190 °C, 2.16 kg) measured according to ISO 1133 of from 0.25 to 30.0 g/lO min.

9. Polypropylene composition (PP) according to claim 7 or 8, wherein the high density polyethylene (HDPE) has

a) a melt flow rate $\text{MFR}_1$ (190 °C, 2.16 kg) measured according to ISO 1133 of from 0.2 to 15.0 g/lO min, and/or

b) a density of at least 930 kg/m$^3$.

10. Polypropylene composition (PP) according to any one of claims 7 to 9, wherein the inorganic filler (F)

a) is selected from the group consisting of talc, mica, calcium carbonate, diatomaceous, wollastonite and kaolin, and/or

b) has an average particle size $d_{50}$ of from 0.65 to 20 µm.

11. Polypropylene composition (PP) according to any one of claims 7-10, wherein the polypropylene composition (PP) has

a) a flexural modulus measured according to ISO 178 of at least 1500 MPa, and/or

b) an izod notched impact strength measured according to ISO 180 (1A; + 23 °C) of > 30 kJ/m$^2$.

12. Polypropylene composition (PP) according to any one of the preceding claims, wherein the first heterophasic propylene copolymer (HPP1) and/or the second heterophasic propylene copolymer (HPP2) are/is a-nucleated, preferably the first heterophasic propylene copolymer (HPP1) and the second heterophasic propylene copolymer (HPP2) are a-nucleated.

13. Article comprising, preferably consisting of, a polypropylene composition (PP) according to any one of the claims 1 to 12.
14. Article according to claim 13, wherein the article is a moulded article, preferably an injection moulded article.

15. Use of a polypropylene composition (PP) according to any one of the claims 1 to 12 for the preparation of a moulded article, preferably an injection moulded article.

16. Use of a polypropylene composition (PP) in the preparation of an article according to claim 13 or 14 for reducing tiger stripes on the surface of said article.
A. CLASSIFICATION OF SUBJECT MATTER

See the extra sheet
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC: C08K 3/-, C08L 23/-

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
WPI, EPODOC, CNKI, CNPAT: borouge, heterophasic, propylene, polypropylene, elastomeric, melt flow rate, HECO, HPP, EP, MER

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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Further documents are listed in the continuation of Box C.

* Special categories of cited documents:
  "A" document defining the general state of the art which is not considered to be of particular relevance
  "E" earlier application or patent but published on or after the international filing date
  "L" document which may throw doubts on priority claim (S) or which is cited to establish the publication date of another citation or other special reason (as specified)
  "O" document referring to an oral disclosure, use, exhibition or other means
  "P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search
09 August 2013 (09.08.2013)

Date of mailing of the international search report
05 Sep. 2013 (05.09.2013)

Name and mailing address of the ISA/CN
The State Intellectual Property Office, the P.R.China
6 Xitucheng Rd., Jimen Bridge, Haidian District, Beijing, China 100088
Facsimile No. 86-10-62019451

Authorized officer
GAO, Xiaowei
Telephone No. (86-10)82246813

Form PCT/ISA /210 (second sheet) (July 2009)
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INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2012/001601

Continuation of A. CLASSIFICATION OF SUBJECT MATTER:
C08K 3/00 (2006.01) i
C08L 23/12 (2006.01) i
C08L 23/10 (2006.01) i