A HIGH ENERGY RETURN FOAM AND METHOD FOR PREPARING THE SAME

FIELD OF THE INVENTION

The present disclosure relates to a high energy return foam and method for preparing the same.

INTRODUCTION

Physical foaming is a hot topic in footwear applications. For this application, high rebound foam is highly preferred. In the market, there is a foaming technology which allows to form crosslinked blockers followed by putting them into an autoclave to obtain the foam. However, many of the foams can only achieve a rebound of 60-65%. Therefore, there still remains a constant demand for a high energy return foam exhibiting a high rebound of not less than 70%, preferably maintaining a low foam density, and/or good mechanical properties at the same time.

After persistent exploration, we have surprisingly found a high energy return foam which can achieve one or more of the above targets.

SUMMARY

The present disclosure provides a high energy return foam derived from a composition comprising from about 30 wt% to about 100 wt% of a polyolefin elastomer having a density of between about 0.857 g/cc and about 0.884 g/cc and a MI of not greater than about 5 g/10 min and from about 0 wt% to about 70 wt% of a polyolefin derivative having a density less than about 0.857 g/cc or greater than about 0.884 g/cc or having a MI of greater than about 5 g/10 min, based on the weight of the composition.

In one aspect of the present disclosure, the present disclosure provides a high energy return foam derived from a composition having a rebound of 74.5% or more, wherein the composition consists essentially of 30 wt% to 100 wt% of a polyolefin elastomer having a density of between 0.857 g/cc and 0.884 g/cc and a MI of not greater than 5 g/10 min, based on the weight of the composition, and from 0 wt% to 70 wt% of a polyolefin derivative selected from the group consisting of low density polyethylene (LDPE), linear low density polyethylene (LLDPE), and combinations thereof, having a density less than 0.857 g/cc or greater than 0.884 g/cc, or having a

MI of greater than 5 g/10 min, wherein the polymer in the composition is crosslinked by peroxide or by irradiation and the crosslinked polymer has a gel% of from 50% to 100% by weight by a hot xylene extraction method, wherein the crosslinked polymer is foamed at a temperature of not less than 90 ºC and at a pressure from 10 to 80 MP.

The present disclosure also provides a method for preparing the high energy return foam as defined herein, comprising:

a) providing a composition comprising from about 30 wt% to about 100 wt% of a polyolefin elastomer having a density of between about 0.857 g/cc and about 0.884 g/cc and a MI of not greater than about 5 g/10 min and from about 0 wt% to about 70 wt% of a polyolefin derivative having a density less than about 0.857 g/cc or greater

than about 0.884 g/cc or having a MI of greater than about 5 g/10 min, based on the weight of the composition;

b) crosslinking the polymers in the composition obtained in step a);

c) foaming the resulting crosslinked polymers obtained in step b).

In another aspect of the present disclosure, the present disclosure provides a method for preparing the high energy return foam as defined herein, comprising:

a) providing a composition having a rebound of 74.5% or more, wherein the composition consists essentially of 30 wt% to 100 wt% of a polyolefin elastomer having a density of between 0.857 g/cc and 0.884 g/cc and a MI of not greater than 5 g/10 min, based on the weight of the composition, and from 0 wt% to 70 wt% of a polyolefin derivative selected from the group consisting of low density polyethylene (LDPE), linear low density polyethylene (LLDPE), and combinations thereof, having a density less than 0.857 g/cc or greater than 0.884 g/cc or having a MI of greater than 5 g/10 min;

b) crosslinking by peroxide or irradiation the polymers in the composition obtained in step a), wherein the crosslinked polymer has a gel% of from 50% to 100% by weight by a hot xylene extraction method; and

c) foaming the resulting crosslinked polymers obtained in step b) at a temperature of not less than 90 ^{o}C and at a pressure from 10 to 80 MPa.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 shows the surface morphology of Examples in Table 1.

DETAILED DESCRIPTION OF THE INVENTION

Unless defined otherwise, all technical and scientific terms used herein have the same meaning as commonly understood by one of ordinary skill in the art to which the invention belongs. Also, all publications, patent applications, patents, and other references mentioned herein are incorporated by reference.

The numerical ranges disclosed herein include all values from, and including, the lower and upper value. For ranges containing explicit values (e.g., 1 or 2; or 3 to 5; or 6; or 7), any subrange between any two explicit values is included (e.g., 1 to 2; 2 to 6; 5 to 7; 3 to 7; 5 to 6; etc.). Unless stated to the contrary, implicit from the context, or customary in the art, all parts and percentages are based on weight and all test methods

are current as of the filing date of this disclosure.

As disclosed herein, the term "composition", "formulation" or "mixture" refers to a physical blend of different components, which is obtained by mixing simply different components by a physical means. The sum of the percentages by weight of each component in a composition is 100 wt%, based on the total weight of the composition.

As disclosed herein, “and/or” means “and, or as an alternative”. All ranges include endpoints unless otherwise indicated.

A "blowing agent" is a substance that is capable of producing a cellular structure in the composition via a foaming process.

The term "polymer" as used herein, refers to a polymeric compound prepared by polymerizing monomers, whether of the same or a different type. The generic term polymer thus, includes the term homopolymer (employed to refer to polymers prepared from only one type of monomer, with the understanding that trace amounts of impurities can be incorporated into the polymer structure), and the term interpolymer as defined hereinafter. Trace amounts of impurities, such as catalyst

Claims:

1. A high energy return foam derived from a composition having a rebound of 74.5% or more, wherein the composition consists essentially of 30 wt% to 100 wt% of a polyolefin elastomer having a density of between 0.857 g/cc and 0.884 g/cc and a MI of not greater than 5 g/10 min, based on the weight of the composition, and from 0 wt% to 70 wt% of a polyolefin derivative selected from the group consisting of low density polyethylene (LDPE), linear low density polyethylene (LLDPE), and combinations thereof, having a density less than 0.857 g/cc or greater than 0.884 g/cc, or having a MI of greater than 5 g/10 min, wherein the polymer in the composition is crosslinked by peroxide or by irradiation and the crosslinked polymer has a gel% of from 50% to 100% by weight by a hot xylene extraction method, wherein the crosslinked polymer is foamed at a temperature of not less than 90 ^{o}C and at a pressure from 10 to 80 MPa.

2. The high energy return foam of claim 1, wherein the polyolefin elastomer is selected from ethylene/α-olefin random copolymer, ethylene/α-olefin multi-block interpolymer, ethylene/α-olefin/nonconjugated polyene interpolymer or a mixture of any two or more of them.

3. The high energy return foam of claim 1, wherein the composition comprises from 35 wt% to 100 wt% of a polyolefin elastomer having a density of between 0.857 g/cc and 0.884 g/cc and a MI of not greater than 5 g/10 min and from 0 wt% to 65 wt% of a polyolefin derivative selected from the group consisting of low density polyethylene (LDPE), linear low density polyethylene (LLDPE), and combinations thereof, having a density less than 0.857 g/cc or greater than 0.884 g/cc or having a MI of greater than 5 g/10 min, based on the weight of the composition.

4. A method for preparing the high energy return foam of any one of the preceding claims, comprising:

a) providing a composition having a rebound of 74.5% or more, wherein the composition consists essentially of 30 wt% to 100 wt% of a polyolefin elastomer having a density of between 0.857 g/cc and 0.884 g/cc and a MI of not greater than 5 g/10 min, based on the weight of the composition, and from 0 wt% to 70 wt% of a polyolefin derivative selected from the group consisting of low density polyethylene (LDPE),

linear low density polyethylene (LLDPE), and combinations thereof, having a density less than 0.857 g/cc or greater than 0.884 g/cc or having a MI of greater than 5 g/10 min;

b) crosslinking by peroxide or irradiation the polymers in the composition obtained in step a), wherein the crosslinked polymer has a gel% of from 50% to 100% by weight by a hot xylene extraction method; and

c) foaming the resulting crosslinked polymers obtained in step b) at a temperature of not less than 90 ^{o}C and at a pressure from 10 to 80 MPa.