Summary of the disclosure

In one aspect, there is provided a liquid formulation for foaming a thermoplastic polystyrene, said formulationconsisting essentially of:

a) 25-90 wt.% of a liquid carrier; and

b) at least one endothermic chemical blowing agent selected from the group consisting of tricarboxylic acids, salts of tricarboxylic acids, esters of tricarboxylic acids, succinic acid, succinic acid salts, succinic acid esters, adipic acid, adipic acid salts, adipic acid esters, phthalic acid, phthalic acid salts, phthalic acid esters, citric acid, citric acid salts and citric acid esters.

In another aspect, there is provided a polymer composition comprising a thermoplastic polystyrene and a liquid formulation as described herein.

In another aspect, there is provided a method of making a polystyrene foam material, the method comprising contacting a thermoplastic polystyrene and a liquid formulation described herein during melt processing under such conditions that the liquid formulation produces gas which foams the polystyrene.

According to a one embodiment of the invention, a liquid formulation for foaming of a thermoplastic polystyrene is provided, said formulation comprising: a liquid carrier; and a particular chemical blowing agent; wherein the liquid carrier works as a modifier or plasticizer in thermoplastic polystyrene.

Subject of the present invention is therefore a liquid formulation for foaming a thermoplastic polystyrene, said formulation comprising

a) 25 to 90 wt.% of a liquid carrier; and

b) at least one endothermic chemical blowing agent selected from the group consisting of tricarboxylic acids, salts of tricarboxylic acids and esters of tricarboxylic acids.

The liquid formulation of the present invention preferably is a dispersion, wherein the endothermic chemical blowing agent is dispersed in the liquid carrier. Solids in the liquid formulation are finely dispersed.

Said liquid formulation preferably comprises from 10 to 90 wt.-%, more preferably from 20 to 80 wt.-%, even more preferably from 30 to 75 wt.-%, most preferably from 40 to 70 wt.-%, of the said chemical foaming agent, based on the total weight of the liquid formulation.

The at least one endothermic chemical blowing agent is preferably selected from organic acids and acid derivatives, such as oxalic acid, oxalic acid salts, oxalic acid esters, succinic acid, succinic acid salts, succinic acid esters, adipic acid, adipic acid salts, adipic acid esters, phthalic acid, phthalic acid salts, phthalic acid esters, citric acid, citric acid salts and citric acid esters. Esters preferably are C_1-C_{18}-alkyl esters.

Salts preferably are alkali metal salts, e.g. sodium salts.

Patent Claims

1. A liquid formulation for foaming a thermoplastic polystyrene, said formulation consisting essentially of:

a) 25-90 wt.% of a liquid carrier; and

b) at least one endothermic chemical blowing agent selected from the group consisting of tricarboxylic acids, salts of tricarboxylic acids, esters of tricarboxylic acids, succinic acid, succinic acid salts, succinic acid esters, adipic acid, adipic acid salts, adipic acid esters, phthalic acid, phthalic acid salts, phthalic acid esters, citric acid, citric acid salts and citric acid esters.

2. The formulation as claimed in claim 1, wherein the formulation is a dispersion wherein the endothermic chemical blowing agent is dispersed in the liquid carrier.

3. The formulation as claimed in any of the preceding claims, wherein the chemical blowing agent is selected from succinic acid, succinic acid salts, succinic acid esters, adipic acid, adipic acid salts, adipic acid esters, phthalic acid, phthalic acid salts, phthalic acid esters, citric acid, citric acid salts and citric acid esters.

4. The formulation as claimed in any of the preceding claims, wherein the chemical blowing agent is selected from citric acid, citric acid salts and citric acid esters.

5. The formulation as claimed in any of the preceding claims, wherein the liquid carrier comprises an aqueous medium, an organic solvent- based medium, an oil-based medium or a combination thereof.

6. The formulation as claimed in any of the preceding claims, wherein the liquid carrier comprises a vegetable oil, a mineral oil, an acetylated monoglyceride, a sorbitan oleate, an ethoxylated sorbitan oleate or a mixture thereof.

7. The formulation as claimed in any of the preceding claims, further comprising customary additives selected from the group consisting of colorants, stabilizers, antioxidants, antibacterial agents, neutralizers, antistatic agents,

antiblocking agents, optical brighteners, heavy metal inactivation agents, hydrophobic agents, peroxides, water scavengers, acid scavengers, hydrotalcites, elastomers, impact modifiers, laser marking additives, processing aids and mixtures thereof.

8. The formulation as claimed in any of the preceding claims, comprising

a) 25 to 90 wt.-% of the liquid carrier,

b) 90 to 10 wt.-% of said at least one endothermic chemical blowing agent, and optionally

c) 0.0001 to 15 wt.-% of customary additives,

based on the total weight (100%) of the liquid formulation, wherein components (a), (b) and (c) add up to 100% by weight.

9. The formulation as claimed in any of the preceding claims, comprising

a) 30 to 60 wt.-% of a liquid carrier,

b) 70 to 40 wt.-%, of said at least one endothermic chemical blowing agent, and optionally

c) 0.1 to 7.5 wt.-% of customary additives,

based on the total weight (100%) of the liquid formulation, wherein components (a), (b) and (c) add up to 100% by weight.

10. Use of a liquid formulation as claimed in any of the preceding claims for preparing a foamed thermoplastic polystyrene material, especially a film or a sheet.

11. A polymer composition comprising a thermoplastic polystyrene and a liquid formulation as claimed in any of claims 1 to 9.

12. The polymer composition of claim 11, wherein the thermoplastic polystyrene is a styrene homopolymer, an alkylstyrene homopolymer, a high-impact polystyrene or a mixture thereof.

13. A method of making a polystyrene foam material, the method comprising contacting a thermoplastic polystyrene and a liquid formulation according to any of

claims 1 to 9 during melt processing under such conditions that the liquid formulation produces gas which foams the polystyrene.

14. The method as claimed in claim 13, the method comprising contacting a thermoplastic polystyrene and a polymer composition according to claims 11 or 12.