(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
1 November 2007 (01.11.2007)

PCT

(10) International Publication Number
WO 2007/124303 A3

(51) **International Patent Classification:**
B29C 47/10 **(2006.01)** ***B29C 45/00*** **(2006.01)**
B29C 49/00 **(2006.01)** ***B29C 47/36*** **(2006.01)**

(21) **International Application Number:**
PCT/US2007/066778

(22) International Filing Date: 17 April 2007 (17.04.2007)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
60/745,116 19 April 2006 (19.04.2006) US

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(81) **Designated States** *(unless otherwise indicated, for every kind of national protection available):* AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BH, **BR,** BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, **HR,** HU, **ID,** IL, IN, IS, **JP,** KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RS, RU, SC, SD, SE, SG, SK, SL, SM, SV, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW

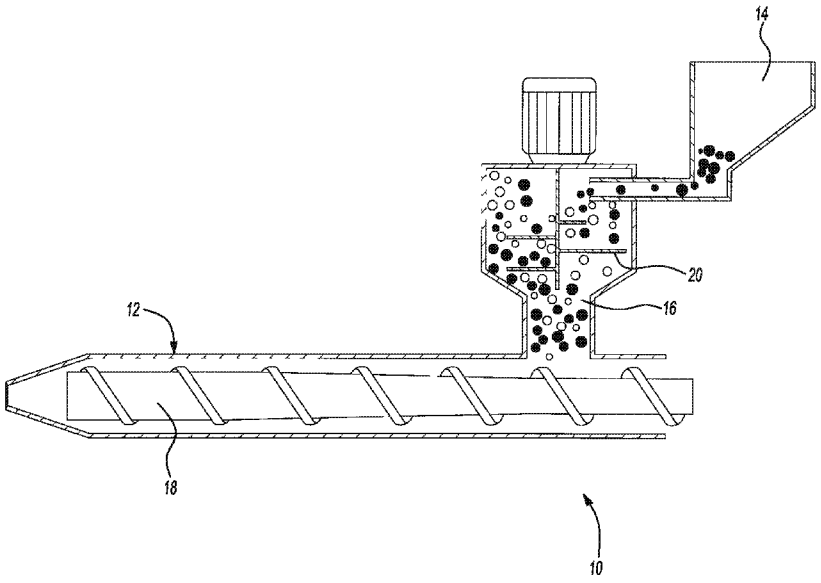
(84) Designated States *(unless otherwise indicated, for every kind of regional protection available):* ARIPO (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IS, IT, LT, LU, LV, MC, MT, NL, PL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:
— *with international search report*
— *with amended claims*

(88) Date of publication of the international search report:
29 May **2008**

Date of publication of the amended claims: 7 August 2008

(54) Title: METHOD FOR BLENDING MATERIALS IN AN EXTRUDER, THE MANUFACTURED ARTICLE AND MATERIAL PRE-MIX



(57) Abstract: The present invention is directed to improved processes for making plastic articles, and articles made therefrom. In a broad aspect, the invention is directed to improved processes and articles made therefrom, that include the steps of providing as separate materials a first material that includes a thermoplastic polyolefin, a second material including an admixture of a particulated filler and a second thermoplastic polyolefin, and a third material that includes an elastomer; applying a shear force to the first, second and third materials, while the materials are at an elevated temperature for blending the materials to form a molten blend; shaping the molten blend and solidifying the molten blend.

WO 2007/124303 A3

AMENDED CLAIMS
received by the International Bureau on 05 June 2008 (05.06.08)

What is claimed is:

1. A process for manufacturing an injection molded article, wherein the process comprises the steps of: feeding to an injection molding machine a first material that includes a polyolefin; feeding to the injection molding machine a second material including an admixture of a particulated filler and a second polyolefin; feeding to the injection molding machine a third material that includes an elastomer; blending the first, second and third materials within the injection molding machine to form a blend; and injecting the blend into a tool wherein the process is free of a step of compounding together the first, second and third materials prior to the blending step.

2. The process of claim 1, wherein the injection molding machine includes a hopper located upstream of a screw and barrel assembly (12), and the feeding steps include feeding the first, second and third materials into the hopper.

3. The process of claim 2, wherein the blending step occurs within the screw and barrel assembly (12), and the screw and barrel assembly has a length to diameter ratio greater than 15:1.

4. The process of any of claims 1 through 3, wherein a back pressure of at least about 0.689 MPa is applied to the first, second and third materials during the blending step.

5. The process of claim 3 or 4, wherein a screw speed of 25 to 250 rpm is employed during the blending step.

6. The process of any of claims 1 through 5, wherein the blending step occurs at a temperature of 180 to 270 ^{0}C.

7. The process of any of claims 1 through 6, wherein the injecting step includes passing the blend through a static mixer.

8. The process of any of claims 1 through 7, wherein the injecting step is part of a multiple operation process selected from blow molding, two stage injection molding, or a combination thereof.

9. The process of any of claims 1 through 8, wherein the screw (18) of the injection molding machine includes a plurality of both in-flow channels and out-flow channels.

10. The process of any of claims 1 through 9, wherein the injection molding machine includes a mixing flight that includes at least one undercut for providing dispersive mixing, at least one bypass channel for providing distributive mixing or both.

11. The process of any of claims 1 through 10, wherein the blending includes dispersive mixing and distributive mixing.

12. The process of any of claims 1 through 11, wherein the polyolefin of the first material is a neat polypropylene homopolymer, a neat polypropylene impact copolymer characterized by a melt flow rate of less than 70g/10 min (at 230 °C, 2.16kg), and containing greater than 8 wt% (of the first material) of ethylene, having greater than 40 % crystallinity, or any combination thereof.

13. The process of any of claims 1 through 12, wherein the particulated filler is a talc.

14. The process of any of claims 1 through 13, wherein the second polyolefin is a neat polypropylene homopolymer, a neat polypropylene impact copolymer characterised by a melt flow rate of less than 70g/10 min (at 230 ^{0}C, 2.16kg), and containing greater than 8 wt% (of the first material) of ethylene, having greater than about 40 % crystallinity, or a combination thereof.

15. The process of any of claims 1 through 14, wherein the elastomer of the third material includes an alpha-olcfin comonomer, and has a density less than about 0.9, a melt flow rate of 0.5 to 30 g/10 min (at 190 °C, 2.16kg), has a glass transition temperature ofless than -30 ^{0}C, or any combination thereof.

16. The process of any of claims 1 through 15, wherein the relative amounts of the first, second and third materials will range from 30 to 90 parts by weight of the first material, optionally up to 30 parts by weight of the second material, and 3 to 40 parts by weight of the third material.

17. The process of any of claims 1 though 16, wherein a viscosity ratio of 0.2 to 7 is employed.

18. The process of any of claims 1 through 17, wherein the resulting article exhibits a lamellar morphology, a droplet morphology having a rubber domain size of 0.1 micron to 5 microns, or a combination thereof.

AMENDED SHEET (ARTICLE 19)

19. The process or any of claims 1 through 18, wherein the resulting article exhibits any combination of at least two of the following properties; namely, a density from.85 to 1.05 g/cc; flexural modulus that ranges from 600 to 2500 MPa; a tensile strength (at yield) of at least 8 MPa, Instrumented Dart Impact failure in a ductile mode in greater than 90% of samples tested, (at -40 ^{0}C, -30 ^{0}C or 0 ^{0}C).

20. An article prepared according to the process of any of claims 1 through 19.

21. A kit for the manufacture of a shaped plastic article, wherein the kit comprises: a first material that consists essentially of a thermoplastic polyolefin; a second material including an admixture of a particulated filler and a second thermoplastic polyolefin; and a third material that consists essentially of an elastomer.

22. The kit of claims 21, wherein the thermoplastic polyolefin of the first material is a neat polypropylene homopolymer, a neat polypropylene impact copolymer characterized by a melt flow rate of less than 70g/10 min (at 230 ^{0}C$_5$ 2.16kg), and containing greater than 8 wt% (of the first material) of ethylene, having greater than 40 % crysiallinily, or any combination thereof.

23. The kit of any of claims 21 or 22, wherein the particulated filler is a talc.

24. The kit of any of claims 21 through 23, wherein the second thermoplastic polyolefin is a neat polypropylene homopolymer, a neat polypropylene impact copolymer characterized by a melt flow rate of less than 70g/10 min (at 230 ^{0}C, 2.16kg), and containing greater than 8 wt% (of the first material) of ethylene, having greater than 40 % crystallinity, or any combination thereof.

25. The kit of any of claims 21 through 24, wherein the elastomer of the third material includes an alpha-olefin comonomer, and has a density less than 0.9 g/cc, a melt flow rate of 0.5 to 30g/10 min (at 190 ^{0}C, 2.16kg), has a glass transition temperature of less than -30 ^{0}C, or any combination thereof.

26. The kit of any of claims 21 through 25, wherein the relative amounts of the first, second and third materials will range from 30 to 90 parts by weight of the first material, 10 to 30 parts by weight of the second material, and 3 to 40 parts by weight of the third material.

27. A process for making a shaped article, wherein the process comprises the steps of providing as separate materials a first material that includes a thermoplastic polyolefin, a second material including an admixture of a particulated filler and a second thermoplastic polyolefin, and a third material that includes an elastomer; applying a shear force to the first, second and third materials, while the materials are at an elevated temperature for blending the materials to form a molten blend; shaping the molten blend and solidifying the molten blend.