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(54) Title: CARBON BLACK CONTAINING EPDM COMPOSITIONS HAVING EITHER A HIGH GLOSS OR TEXTURED  
MATTE FINISH

(57) **Abrégé/Abstract:**

EPDM compositions comprising EPDM and specified carbon blacks which, when extruded or shaped, exhibit either a highly gloss or a textured matte finish. The carbon black is present in an amount of 100 to about 300, and more preferably about 150 to about 250 parts by weight per 100 parts by weight EPDM.

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

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| <b>(21) International Application Number:</b> PCT/US93/08070<br><b>(22) International Filing Date:</b> 27 August 1993 (27.08.93)<br><br><b>(30) Priority data:</b><br>07/936,818                      27 August 1992 (27.08.92)                      US<br>08/086,793                      2 July 1993 (02.07.93)                      US<br><br><b>(71) Applicant:</b> CABOT CORPORATION [US/US]; 75 State Street, Boston, MA 02109-1806 (US).<br><br><b>(72) Inventors:</b> MACKAY, Bruce, E. ; 1 Summer Street, Framingham, MA 01701 (US). CHUNG, Bin ; 12 Dacon Drive, Nashua, NH 03063 (US). FUNT, John, M. ; 11 Byron Drive, Nashua, NH 03062 (US). WILKINSON, Mark, A. ; 61 Harding Road, Lexington, MA 02173 (US). |  | <b>(74) Agent:</b> CHALETSKY, Lawrence, A.; Cabot Corporation, 157 Concord Road, Billerica, MA 01821 (US).<br><br><b>(81) Designated States:</b> AT, AU, BB, BG, BR, BY, CA, CH, CZ, DE, DK, ES, FI, GB, HU, JP, KR, KZ, LK, LU, MG, MN, MW, NL, NO, NZ, PL, PT, RO, RU, SD, SE, SK, UA, VN, European patent (AT, BE, CH, DE, DK, ES, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, ML, MR, NE, SN, TD, TG).<br><br><b>Published</b><br><i>With international search report.</i><br><i>Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.</i><br><br><b>(88) Date of publication of the international search report:</b><br>28 April 1994 (28.04.94) |
| <b>(54) Title:</b> CARBON BLACK CONTAINING EPDM COMPOSITIONS HAVING EITHER A HIGH GLOSS OR A TEXTURED MATTE FINISH<br><br><b>(57) Abstract</b><br><br>EPDM compositions comprising EPDM and specified carbon blacks which, when extruded or shaped, exhibit either a highly gloss or a textured matte finish. The carbon black is present in an amount of 100 to about 300, and more preferably about 150 to about 250 parts by weight per 100 parts by weight EPDM.                                                                                                                                                                                                                                                       |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |

CARBON BLACK CONTAINING EPDM COMPOSITIONS  
HAVING EITHER A HIGH GLOSS OR A TEXTURED MATTE FINISH

FIELD OF THE INVENTION

5       The present invention relates to EPDM compositions containing certain carbon blacks which when extruded or shaped have either a high gloss finish or a textured matte finish.

BACKGROUND

Carbon blacks have been widely utilized as fillers and  
10 reinforcing pigments in the compounding and preparation of EPDM compositions. Carbon blacks are generally characterized on the basis of their properties including, but not limited to, their surface areas, surface chemistry, aggregate sizes, and particle sizes. The properties of carbon blacks are  
15 analytically determined by tests known to the art, including iodine adsorption number ( $I_2No.$ ) and dibutyl phthalate adsorption (DBP).

Heretofore generally known carbon black containing EPDM compositions yield profiles having a dull and flat surface  
20 finish when extruded or shaped. In contrast, a smooth glossy finish has a high degree of reflectance when viewed at any angle, in part due to the smooth nature of the surface. Conversely, a textured matte finish has a low degree of reflectance due in part to the rugged nature of the surface.  
25 EPDM compositions with high gloss or textured matte finishes are useful in industrial applications such as automotive weather stripping.

SUMMARY OF THE INVENTION

We have discovered EPDM compositions containing certain  
30 carbon blacks that yield profiles having either high gloss or textured matte finishes when extruded or shaped. The EPDM compositions comprise ethylene-propylene diene monomer (EPDM)

and a specified carbon black, which when incorporated into the EPDM will provide articles having a desired high gloss or textured matte finish.

5 The amount of carbon black in the EPDM composition is such that the EPDM composition will, when extruded or shaped, yield profiles having a high gloss or textured matte finish. The amounts of carbon black utilized range from 100 to about 300 parts by weight for each 100 parts by weight of EPDM. It is, however, preferred to use amounts varying from about 150  
10 to about 250 parts by weight of carbon black per 100 parts by weight of EPDM.

EPDM is well known and is commercially available from a variety of sources. The EPDM composition of the present invention may be produced by techniques generally known to  
15 those of ordinary skill in the art for mixing rubbers or polymers and carbon black. As will be understood by those of ordinary skill in the art the high gloss and textured matte finish EPDM compositions of the present invention are produced after extruding or otherwise shaping the carbon black-EPDM  
20 mixture.

The high gloss or textured matte finish EPDM compositions of the present invention are advantageous for use in applications where a high gloss or textured matte finish is desirable. One such application is automotive  
25 weatherstripping.

Other advantages of the present invention will become apparent from the following more detailed description of the invention.

## DETAILED DESCRIPTION OF THE INVENTION

The EPDM compositions of the present invention which will yield a high gloss finish comprise EPDM and a carbon black selected from the group consisting of carbon blacks having a CTAB of about 10 m<sup>2</sup>/g to about 30 m<sup>2</sup>/g and a ratio of DBP/CTAB greater than about 4, preferably a CTAB of about 25 m<sup>2</sup>/g and a ratio of DBP/CTAB of about 5.3; and carbon blacks having a CTAB of about 30 m<sup>2</sup>/g to about 70 m<sup>2</sup>/g and a DBP greater than about 125 cc/100g, preferably a DBP of about 125 cc/100g to about 160 cc/100g, and most preferably a CTAB of about 47 m<sup>2</sup>/g and a DBP of about 126 cc/100g.

The EPDM compositions of the present invention which will yield a textured matte finish comprise EPDM and a carbon black having a CTAB of about 10 m<sup>2</sup>/g to about 70 m<sup>2</sup>/g and a ratio of DBP/CTAB less than about 1.5, preferably a CTAB of about 45 m<sup>2</sup>/g and a ratio of DBP/CTAB of about 1.0, and most preferably a CTAB of about 67 m<sup>2</sup>/g and a ratio of DBP/CTAB of about 0.7.

The amount of carbon black in the compositions of the present invention is sufficient to allow the EPDM composition to yield a profile having either a gloss or a textured matte finish after extruding or shaping. The amounts of carbon black to be incorporated into the EPDM compositions of the present invention range from 100 to about 300 parts by weight carbon black per 100 parts by weight EPDM, preferably from about 150 to about 250 parts by weight carbon black per 100 parts by weight EPDM.

The high gloss or textured matte finish EPDM compositions of the present invention may also contain conventional additives such as oils, stabilizers, oxides, acids, curing agents etc. known to those of ordinary skill in the art as useful for incorporation into, and during the formation of, EPDM compositions.

The high gloss or textured matte finish EPDM compositions of the present invention may be produced in any manner known to those of ordinary skill in the art for producing EPDM compositions incorporating carbon blacks. One method for producing the high gloss or textured matte finish compositions

of the present invention, utilizing a Banbury\* BR mixer, is as follows.

The Banbury\* BR mixer is started and maintained at a temperature of 45° C and a rotor speed of 77 RPM. EPDM is added to the mixer and mixed for approximately 30 seconds. Oil, and preferably zinc oxide and stearic acid, or compounds having similar properties, are added to the EPDM and mixed for approximately 2 additional minutes. The carbon black is added to the mixture and the temperature of the mixing chamber is cooled and maintained at a temperature of below approximately 135° C. The carbon black - EPDM mixture is mixed for approximately 4 1/2 minutes and then curing agents are added to the mixture. The resulting mixture is mixed for approximately 1 1/2 minutes while the temperature is maintained at below approximately 135° C. The compound is then discharged from the mixer and extruded, or otherwise formed and cooled to form the high gloss or textured matte finish EPDM compositions of the present invention. By way of example, the batch compound may be extruded on a Brabender\* extruder at 50 RPM and 100° C through a die having an opening of 1 inch in width and 0.020 inch in height. This will yield a profile having a high gloss or textured matte finish.

Although one method for producing the high gloss or textured matte finish EPDM compositions of the present invention has been described, the high gloss or textured matte finish EPDM compositions of the present invention may be produced by other methods for producing polymer or rubber compositions known to those of ordinary skill in the art.

The following testing procedures are used in the determination and evaluation of the analytical properties of the carbon blacks utilized in the following examples.

The DBP (dibutyl phthalate adsorption value) of the carbon black was determined according to the procedure set forth in ASTM D2414. The I<sub>2</sub>No. (iodine adsorption number) of the carbon blacks was determined according to ASTM D1510. CTAB (cetyl-trimethyl ammonium bromide) absorption value of the carbon blacks was determined according to ASTM Test

Procedure D3765-85. Tinting strength (Tint) of the carbon blacks was determined according to ASTM Test Procedure D3265-85a. The CDBP (dibutyl phthalate adsorption value) of the crushed carbon blacks was determined according to the procedure set forth in ASTM D3493-86.

The effectiveness and advantages of the present invention will be further illustrated by the following example.

#### EXAMPLE

Eighteen EPDM compositions were prepared incorporating six different carbon blacks at each of three different loading levels into EPDM. Carbon blacks A and B were utilized to produce textured matte finish EPDM compositions of the present invention RA1 - RA3 and RB1 - RB3, respectively. Two control carbon blacks, C and D, were utilized to produce EPDM compositions RC1 - RC3 and RD1 - RD3, respectively. Carbon blacks E and F were utilized to produce high gloss EPDM compositions of the present invention RE1-RE3 and RF1-RF3, respectively. The analytical properties of the carbon blacks A-F were as shown in Table 1 below:

Table 1

#### Carbon Blacks

|                              | A   | B   | C   | D   | E   | F   |
|------------------------------|-----|-----|-----|-----|-----|-----|
| I <sub>2</sub> No.<br>(mg/g) | 40  | 63  | 30  | 35  | 22  | 51  |
| CTAB (m <sup>2</sup> /g)     | 45  | 67  | 30  | 36  | 25  | 47  |
| DBP<br>(cc/100g)             | 44  | 49  | 69  | 91  | 132 | 126 |
| CDBP<br>cc/100g              | 43  | 45  | 59  | 72  | 77  | 83  |
| Tint (%)                     | 80  | 101 | 52  | 57  | 33  | 60  |
| DBP/CTAB                     | 1.0 | 0.7 | 2.3 | 2.5 | 5.3 | 2.7 |

EPDM compositions RA1, RA2, RA3; RB1, RB2, RB3; RC1, RC2, RC3; RD1, RD2, RD3; RE1, RE2, RE3; and RF1, RF2, RF3 were prepared utilizing each of the carbon black samples in amounts of 150 parts by weight, 200 parts by weight and 250 parts by weight

parts by weight, 200 parts by weight and 250 parts by weight in the EPDM Compound Formulation shown below in Table 3. The carbon black and amount by weight of the carbon black utilized in the EPDM compositions were as shown in Table 2.

Table 2

| EPDM COMPOSITION | CARBON BLACK | AMOUNT BY WEIGHT |
|------------------|--------------|------------------|
| RA1              | A            | 150              |
| RA2              | A            | 200              |
| RA3              | A            | 250              |
| RB1              | B            | 150              |
| RB2              | B            | 200              |
| RB3              | B            | 250              |
| RC1              | C            | 150              |
| RC2              | C            | 200              |
| RC3              | C            | 250              |
| RD1              | D            | 150              |
| RD2              | D            | 200              |
| RD3              | D            | 250              |
| RE1              | E            | 150              |
| RE2              | E            | 200              |
| RE3              | E            | 250              |
| RF1              | F            | 150              |
| RF2              | F            | 200              |
| RF3              | F            | 250              |

TABLE 3 - EPDM COMPOUND FORMULATION

| INGREDIENT      | PART BY WEIGHT |
|-----------------|----------------|
| EPDM            | 100            |
| Carbon Black    | 150/200/250    |
| Sunpar 2280 Oil | 100            |
| Zinc Oxide      | 5              |
| Stearic Acid    | 1              |
| TMTDS           | 2.7            |
| Butyl Zimate    | 2.7            |
| Methyl Zimate   | 2.7            |
| Sulfur          | 0.5            |
| Sulfasan R      | 1.7            |

EPDM -EXXON VISTALON® 5600, manufactured and sold by EXXON Corporation, Wilmington, Delaware;

Sunpar 2280 - A trademarked oil manufactured and sold by Sun Oil Company;

TMTDS - tetramethylthiuram disulfide;

Butyl Zimate - a trademarked zinc

dibutyldithiocarbamate manufactured and sold by  
R. T. Vanderbilt Co.;

Methyl Zimate - a trademarked zinc

dimethyldithiocarbamate manufactured and sold by

5 R. T. Vanderbilt Co.;

Sulfasan R - a trademarked 4,4' - dithiodimorpholine,  
manufactured and sold by Monsanto, Co., St. Louis,  
Missouri.

The EPDM compounds were produced as follows. A Banbury BR  
10 mixer was started and maintained at a temperature of 45° C  
and a rotor speed of 77 RPM. EPDM was added to the mixer  
and mixed for approximately 30 seconds. The Sunpar 2280  
oil, zinc oxide and stearic acid, were added to the EPDM  
and mixed for approximately 2 additional minutes. The  
15 carbon black was added to the mixture and the temperature  
of the mixing chamber was cooled and maintained at a  
temperature of below approximately 135° C. The carbon  
black - EPDM mixture was mixed for approximately 4 1/2  
minutes and then the TMTDS, Butyl Zimate, Methyl Zimate,  
20 Sulfur and Sulfasan R products were added to the mixture.  
The resulting mixture was mixed for approximately 1 1/2  
minutes while the temperature was maintained at below  
approximately 135° C. The batch compound was then  
discharged from the mixer and extruded on a Brabender  
25 extruder at 50 RPM and 100°C. through a die having an  
opening of 1 inch in width and 0.020 inch in height to  
produce the EPDM compositions RA1-RF3 in the form of  
profiles.

Upon visual inspection, the finish of each of the EPDM profiles was as follows:

| EPDM<br>COMPOSITION | FINISH                                             |
|---------------------|----------------------------------------------------|
| RA1<br>RA2<br>RA3   | Textured Matte<br>Textured Matte<br>Textured Matte |
| RB1<br>RB2<br>RB3   | Textured Matte<br>Textured Matte<br>Textured Matte |
| RC1<br>RC2<br>RC3   | Dull and Flat<br>Dull and Flat<br>Dull and Flat    |
| RD1<br>RD2<br>RD3   | Dull and Flat<br>Dull and Flat<br>Dull and Flat    |
| RE1<br>RE2<br>RE3   | High Gloss<br>High Gloss<br>High Gloss             |
| RF1<br>RF2<br>RF3   | High Gloss<br>High Gloss<br>High Gloss             |

These results show that the EPDM compositions RA1-RA3 and RB1-RB3 of the present invention have a textured matte finish whereas EPDM compositions RE1-RE3 and RF1-RF3 have a high gloss finish. Samples produced with the control carbon blacks, RC1-RC3 and RF1-RF3, have a dull and flat surface appearance which is neither highly glossy nor textured matte.

It should be clearly understood that the forms of the present invention herein described are illustrative only and are not intended to limit the scope of the invention.

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## CLAIMS:

1. An EPDM (ethylene-propylene-diene monomer) composition comprising EPDM and a carbon black having a CTAB of about  $10 \text{ m}^2/\text{g}$  to about  $70 \text{ m}^2/\text{g}$  and a ratio of DBP/CTAB less than about 1.5, wherein the carbon black is present in an amount of 100 to about 300 parts by weight carbon black per 100 parts by weight EPDM.
2. The EPDM composition of claim 1, wherein the carbon black is present in an amount of about 150 to about 250 parts by weight carbon black per 100 parts by weight EPDM.
3. The EPDM composition of claim 1 or 2, wherein the carbon black has a CTAB of about  $45 \text{ m}^2/\text{g}$  and a ratio of DBP/CTAB of about 1.0.
4. The EPDM composition of claim 1 or 2, wherein the carbon black has a CTAB of about  $67 \text{ m}^2/\text{g}$  and a ratio of DBP/CTAB of about 0.7.
5. An EPDM composition comprising EPDM and a carbon black having a CTAB of about  $10 \text{ m}^2/\text{g}$  to about  $30 \text{ m}^2/\text{g}$  and a ratio of DBP/CTAB greater than about 4, wherein the carbon black is present in an amount of 100 to about 300 parts by weight carbon black per 100 parts by weight EPDM.
6. The EPDM composition of claim 5, wherein the carbon black is present in an amount of about 150 to about 250 parts by weight carbon black per 100 parts by weight EPDM.

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7. The EPDM composition of claim 5 or 6, wherein the carbon black has a CTAB of about 25 m<sup>2</sup>/g and a ratio of DBP/CTAB of about 5.3.

8. The EPDM composition of claim 7, wherein the carbon black has a Tint of 33%.

9. The EPDM composition of claim 5 or 6, wherein the carbon black has a CTAB of about 25 m<sup>2</sup>/g, and a DBP of 132 cc/100g.

10. An EPDM composition comprising EPDM and a carbon black having a CTAB of about 30 m<sup>2</sup>/g to about 47 m<sup>2</sup>/g, a DBP of at least about 125 cc/100g, wherein the carbon black is present in an amount of 100 to about 300 parts by weight carbon black per 100 parts by weight EPDM.

11. The EPDM composition of claim 10, wherein the carbon black is present in an amount of about 150 to about 250 parts by weight carbon black per 100 parts by weight EPDM.

12. The EPDM composition of claim 10 or 11, wherein the carbon black has a DBP of about 125 cc/100g to about 160 cc/100g.

13. The EPDM composition of claim 10 or 11, wherein the carbon black has a CTAB of about 47 m<sup>2</sup>/g and a DBP of about 126 cc/100g.

14. The EPDM composition of claim 13, wherein the carbon black has a Tint of 60%.