



US012049551B2

(12) **United States Patent**
Tu et al.

(10) **Patent No.:** **US 12,049,551 B2**
(45) **Date of Patent:** **Jul. 30, 2024**

(54) **COMPOSITE PARTICLES FOR TONER ADDITIVES**

(71) Applicant: **Cabot Corporation**, Boston, MA (US)

(72) Inventors: **Hairuo Tu**, Boxborough, MA (US);
Jincheng Xiong, Boxborough, MA (US); **Paul S. Palumbo**, West Newton, MA (US); **Dmitry Fomitchev**, Lexington, MA (US)

(73) Assignee: **Cabot Corporation**, Boston, MA (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 683 days.

(21) Appl. No.: **17/265,664**

(22) PCT Filed: **Aug. 6, 2019**

(86) PCT No.: **PCT/US2019/045225**

§ 371 (c)(1),

(2) Date: **Feb. 3, 2021**

(87) PCT Pub. No.: **WO2020/033357**

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(65) **Prior Publication Data**

US 2021/0380779 A1 Dec. 9, 2021

Related U.S. Application Data

(60) Provisional application No. 62/868,172, filed on Jun. 28, 2019, provisional application No. 62/858,585, (Continued)

(51) **Int. Cl.**
G03G 9/097 (2006.01)
C08K 3/36 (2006.01)

(Continued)

(52) **U.S. Cl.**

CPC **C08K 3/36** (2013.01); **C08K 9/06** (2013.01); **C09C 1/3081** (2013.01); (Continued)

(58) **Field of Classification Search**

CPC G03G 9/09716; G03G 9/09725; G03G 9/09783

See application file for complete search history.

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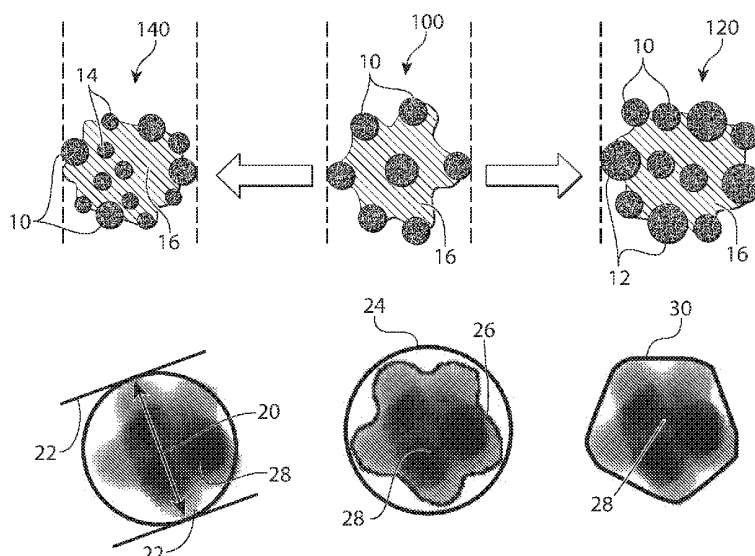
The International Search Report and the Written Opinion of the International Searching Authority, or the Declaration, of International Application No. PCT/US2019/045225, mailed Oct. 28, 2019.

Primary Examiner — Peter L Vajda

(57) **ABSTRACT**

Metal oxide-polymer composite particles have a median particle size D50 of 40-75 nm or 100-150 nm and an average RTA of at least 0.06. Alternatively or in addition, metal oxide-polymer composites comprise two or more populations of metal oxide particles differing in size, particle size distribution, or shape. Alternatively or in addition, the use of a multicomponent hydrophobizing system including an alkylsilane to fabricate metal oxide-polymer composite particles increases the tribocharge of the composite particles.

20 Claims, 13 Drawing Sheets





US012024616B2

(12) **United States Patent**
Thielen et al.

(10) **Patent No.: US 12,024,616 B2**
(45) **Date of Patent: Jul. 2, 2024**

(54) **METHOD OF PRODUCING
THERMOPLASTIC ELASTOMERS AND
POLYMER COMPOSITE OBTAINED
THEREBY**

(71) Applicant: **Cabot Corporation**, Boston, MA (US)

(72) Inventors: **Alain Thielen**, Thimister (BE); **Marc
B. Delvaux**, Liege (BE); **Eugene N.
Step**, Newton, MA (US)

(73) Assignee: **Cabot Corporation**, Boston, MA (US)

(*) Notice: Subject to any disclaimer, the term of this
patent is extended or adjusted under 35
U.S.C. 154(b) by 0 days.

(21) Appl. No.: **17/591,894**

(22) Filed: **Feb. 3, 2022**

(65) **Prior Publication Data**

US 2022/0251340 A1 Aug. 11, 2022

Related U.S. Application Data

(60) Provisional application No. 63/147,912, filed on Feb.
10, 2021.

(51) **Int. Cl.**
C08K 9/06 (2006.01)
C08G 63/672 (2006.01)
C08G 69/40 (2006.01)

(52) **U.S. Cl.**
CPC **C08K 9/06** (2013.01); **C08G 63/672**
(2013.01); **C08G 69/40** (2013.01)

(58) **Field of Classification Search**
CPC C08K 9/06; C08K 9/04; C08K 2201/006;
C08K 3/36; C08G 63/672; C08G 69/40
See application file for complete search history.

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International Searching Authority, or the Declaration of Interna-
tional Application No. PCT/US2022/015039, dated May 6, 2022.

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Primary Examiner — Robert D Harlan

(57) **ABSTRACT**

A method of producing a thermoplastic elastomer includes
providing a polyether composition comprising at least a first
diol terminated polyether having a number average molecu-
lar weight of 400-6000 and up to 15 wt % of fumed silica
having C1-C8 alkylsilyl groups or acrylate or methacrylate
ester groups at its surface, combining the polyether compo-
sition with optional additional first polyether and either a) at
least one dicarboxylic acid and at least one organic diol
having a molecular weight less than 250 or b) at least one
dicarboxylate terminated polyamide, to form a prepolymer
composition, and allowing the prepolymer composition to
polymerize to form a thermoplastic elastomer.

10 Claims, No Drawings



US012018162B2

(12) **United States Patent**
Liu et al.

(10) **Patent No.:** **US 12,018,162 B2**
(45) **Date of Patent:** **Jun. 25, 2024**

(54) **ACRYLIC POLYMERS FOR INKJET INK APPLICATIONS**

(71) Applicant: **Cabot Corporation**, Boston, MA (US)

(72) Inventors: **Tianqi Liu**, Boxborough, MA (US);
Jinqi Xu, Westford, MA (US)

(73) Assignee: **Cabot Corporation**, Boston, MA (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 586 days.

(21) Appl. No.: **17/287,289**

(22) PCT Filed: **Oct. 23, 2019**

(86) PCT No.: **PCT/US2019/057597**

§ 371 (c)(1),

(2) Date: **Apr. 21, 2021**

(87) PCT Pub. No.: **WO2020/086678**

PCT Pub. Date: **Apr. 30, 2020**

(65) **Prior Publication Data**

US 2021/0395548 A1 Dec. 23, 2021

Related U.S. Application Data

(60) Provisional application No. 62/750,498, filed on Oct. 25, 2018.

(51) **Int. Cl.**

C09D 11/322 (2014.01)

C09D 11/107 (2014.01)

C09D 11/324 (2014.01)

C09D 11/38 (2014.01)

(52) **U.S. Cl.**

CPC **C09D 11/322** (2013.01); **C09D 11/107** (2013.01); **C09D 11/324** (2013.01); **C09D 11/38** (2013.01)

(58) **Field of Classification Search**

CPC ... C09D 11/322; C09D 11/107; C09D 11/324; C09D 11/38

See application file for complete search history.

(56) **References Cited**

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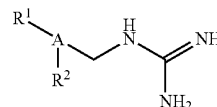
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Primary Examiner — Patrick D Niland

(57)

ABSTRACT

Disclosed herein are inkjet ink compositions comprising: at least one pigment having attached at least one organic group having a calcium index value greater than a calcium index value of 1,2,3-benzene tricarboxylic acid; at least one acrylic polymer having an acid number of at least 150 KOH/g and a weight average molecular weight ranging from 1,000 to 15,000, wherein the at least one acrylic polymer is at least partially neutralized with a base having the following structure: wherein: A is a C₂-C₁₂ alkyl, R¹ is selected from H, C₁-C₁₂ alkyl, an amine having the formula —NR³R⁴, and a guanidine residue having the formula —N(R⁵)—C(=NH)—N(R⁶)(R⁷), wherein R₃ to R₇ are independently selected from H and C₁-C₁₂ alkyl, and R² is selected from H, C₁-C₁₂ alkyl, and an acid group. The inkjet ink composition further comprises an aqueous liquid medium.



28 Claims, No Drawings



US011987501B2

(12) **United States Patent**
Nguyen et al.

(10) **Patent No.:** **US 11,987,501 B2**
(45) **Date of Patent:** **May 21, 2024**

(54) **AQUEOUS HYDROPHOBIC SILICA
DISPERSIONS**

(71) Applicant: **Cabot Corporation**, Boston, MA (US)

(72) Inventors: **Lang H. Nguyen**, Lowell, MA (US);
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Steven Jacobs, Edgartown, MA (US);
Tianqi Liu, Boxborough, MA (US);
Melissa J. Monello, Waltham, MA
(US); **Angelica M. Sanchez Garcia**,
Somerville, MA (US); **Zhangliang Gui**,
Shanghai (CN); **Takashi Umebara**,
Yokohama (JP)

(73) Assignee: **Cabot Corporation**, Boston, MA (US)

(*) Notice: Subject to any disclaimer, the term of this
patent is extended or adjusted under 35
U.S.C. 154(b) by 781 days.

(21) Appl. No.: **16/959,278**

(22) PCT Filed: **Jan. 24, 2019**

(86) PCT No.: **PCT/CN2019/072987**

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(2) Date: **Jun. 30, 2020**

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PCT Pub. Date: **Aug. 1, 2019**

(65) **Prior Publication Data**

US 2021/0053833 A1 Feb. 25, 2021

Related U.S. Application Data

(60) Provisional application No. 62/621,684, filed on Jan.
25, 2018.

(51) **Int. Cl.**
C01B 33/141 (2006.01)
C09D 7/40 (2018.01)
(Continued)

(52) **U.S. Cl.**
CPC **C01B 33/1417** (2013.01); **C09D 7/61**
(2018.01); **C09D 7/70** (2018.01); **C09D**
133/04 (2013.01);
(Continued)

(58) **Field of Classification Search**
None
See application file for complete search history.

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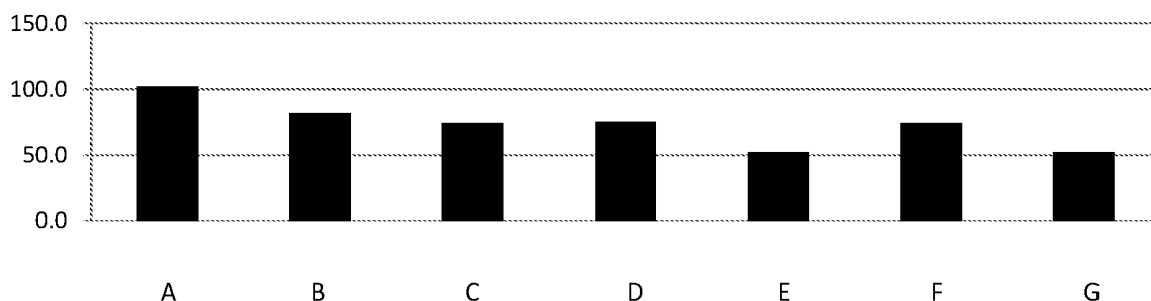
Primary Examiner — Ronak C Patel

(57) **ABSTRACT**

An aqueous hydrophobic silica dispersion includes a hydro-
philic particulate silica, a hydrophobic particulate silica
having a methanol number of at least 60, and a dispersant
having at least one cationic or cationizable group and an
HLB ratio of 2 to 20.

20 Claims, 4 Drawing Sheets

Gloss, 20°





US011912898B2

(12) **United States Patent**
Gui et al.

(10) **Patent No.:** **US 11,912,898 B2**
(45) **Date of Patent:** **Feb. 27, 2024**

(54) **LIGHT COLOR CONDUCTIVE COATINGS**

(56) **References Cited**

(71) Applicant: **Cabot Corporation**, Boston, MA (US)

U.S. PATENT DOCUMENTS

(72) Inventors: **Zhangliang Gui**, Shanghai (CN);
Jin-nan Liu, Shanghai (CN); **Shi-Lin Wang**, Shanghai (CN)

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423/447.2

(Continued)

(73) Assignee: **Cabot Corporation**, Boston, MA (US)

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(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

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(21) Appl. No.: **17/910,174**

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(22) PCT Filed: **Mar. 11, 2021**

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(86) PCT No.: **PCT/CN2021/080160**

§ 371 (c)(1),

(2) Date: **Sep. 8, 2022**

(87) PCT Pub. No.: **WO2021/180158**

PCT Pub. Date: **Sep. 16, 2021**

Primary Examiner — Mark Kopec

Assistant Examiner — Jaison P Thomas

(65) **Prior Publication Data**

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(57) **ABSTRACT**

(30) **Foreign Application Priority Data**

Mar. 12, 2020 (WO) PCT/CN2020/078992

(51) **Int. Cl.**

C09D 5/24 (2006.01)

C09D 7/20 (2018.01)

(Continued)

(52) **U.S. Cl.**

CPC **C09D 5/24** (2013.01); **C09D 7/20**

(2018.01); **C09D 7/61** (2018.01); **C09D 7/66**

(2018.01); **C09D 7/70** (2018.01)

(58) **Field of Classification Search**

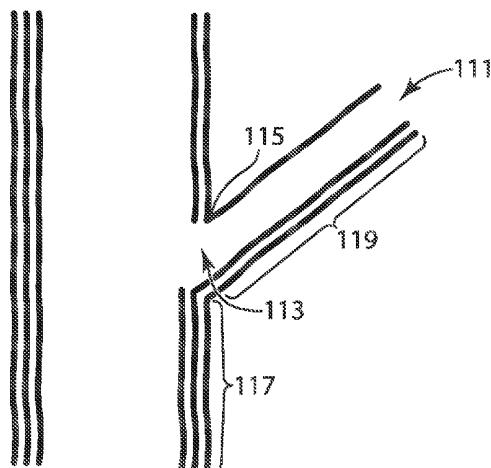
CPC .. C08K 3/041; C08K 3/22; C08K 2003/2241;

C09D 17/004; C09D 5/24; C09D 7/20;

(Continued)

A CNS millbase dispersion, comprises a solvent and up to 0.5 wt % of at least one CNS-derived material dispersed in the millbase dispersion and selected from the group consisting of: carbon nanostructures, fragments of carbon nanostructures, fractured carbon nanotubes, and any combination thereof. The carbon nanostructures or fragments of carbon nanostructures include a plurality of multiwall carbon nanotubes that are crosslinked in a polymeric structure by being branched, interdigitated, entangled and/or sharing common walls, and the fractured carbon nanotubes are derived from the carbon nanostructures and are branched and share common walls with one another. A Brookfield viscosity of the dispersion measured at room temperature at 10 rpm is less than 3000 cP.

14 Claims, 6 Drawing Sheets





US011901559B2

(12) **United States Patent**
Korchev et al.

(10) **Patent No.:** **US 11,901,559 B2**
(45) **Date of Patent:** **Feb. 13, 2024**

(54) **ANODE ELECTRODE COMPOSITIONS AND AQUEOUS DISPERSIONS FOR BATTERY APPLICATIONS**

(71) Applicant: **Cabot Corporation**, Boston, MA (US)

(72) Inventors: **Andriy Korchev**, Westford, MA (US);
Yilun Tang, Waltham, MA (US)

(73) Assignee: **Cabot Corporation**, Boston, MA (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **17/438,726**

(22) PCT Filed: **Feb. 21, 2020**

(86) PCT No.: **PCT/US2020/019198**

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(2) Date: **Sep. 13, 2021**

(87) PCT Pub. No.: **WO2020/197672**

PCT Pub. Date: **Oct. 1, 2020**

(65) **Prior Publication Data**

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Related U.S. Application Data

(60) Provisional application No. 62/822,101, filed on Mar. 22, 2019.

(51) **Int. Cl.**
H01M 4/62 (2006.01)
C01B 32/174 (2017.01)

(Continued)

(52) **U.S. Cl.**
CPC **H01M 4/625** (2013.01); **C01B 32/174**
(2017.08); **C09C 1/48** (2013.01); **H01M 4/133**
(2013.01);

(Continued)

(58) **Field of Classification Search**

CPC H01M 4/04; H01M 4/62; H01M 10/525;
C01B 32/158

See application file for complete search history.

(56) **References Cited**

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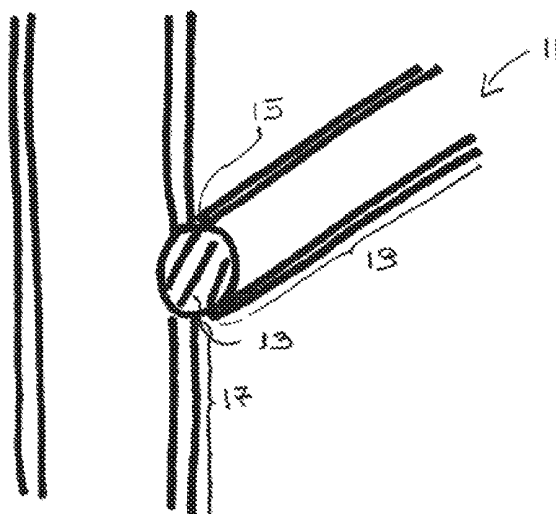
(Continued)

Primary Examiner — Khanh T Nguyen

(57) **ABSTRACT**

Carbon nanostructures are used to prepare electrode compositions for lithium ion batteries. In one example, carbon nanostructures, fragments of carbon nanostructures and/or fractured carbon nanotubes are provided in an aqueous dispersion that can be used in the manufacture of silicon-containing anodes. The aqueous dispersion can further include another conductive carbon additive such as carbon black.

18 Claims, 12 Drawing Sheets





US011434333B2

(12) **United States Patent**
Reynolds et al.

(10) **Patent No.:** **US 11,434,333 B2**
(45) **Date of Patent:** **Sep. 6, 2022**

(54) **METHODS OF PRODUCING AN ELASTOMER COMPOUND AND ELASTOMER COMPOUNDS**

(71) Applicant: **Cabot Corporation**, Boston, MA (US)

(72) Inventors: **David C. Reynolds**, Winchester, MA (US); **Gerald D. Adler**, Charlestown, MA (US); **Martin C. Green**, Boxborough, MA (US)

(73) Assignee: **Cabot Corporation**, Boston, MA (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 172 days.

(21) Appl. No.: **16/761,344**

(22) PCT Filed: **Nov. 8, 2018**

(86) PCT No.: **PCT/US2018/059762**

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(2) Date: **May 4, 2020**

(87) PCT Pub. No.: **WO2019/094551**

PCT Pub. Date: **May 16, 2019**

(65) **Prior Publication Data**

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Related U.S. Application Data

(60) Provisional application No. 62/584,588, filed on Nov. 10, 2017.

(51) **Int. Cl.**

C08J 3/22 (2006.01)
C08J 3/20 (2006.01)
C08K 3/04 (2006.01)
C08K 3/22 (2006.01)
C08K 3/36 (2006.01)
C08K 9/02 (2006.01)
C08L 7/02 (2006.01)
C08L 9/10 (2006.01)
B01F 23/70 (2022.01)

(52) **U.S. Cl.**

CPC **C08J 3/226** (2013.01); **B01F 23/704** (2022.01); **C08J 3/203** (2013.01); **C08K 3/04** (2013.01); **C08K 3/22** (2013.01); **C08K 3/36** (2013.01); **C08K 9/02** (2013.01); **C08L 7/02** (2013.01); **C08L 9/10** (2013.01); **C08K 2003/2227** (2013.01); **C08K 2003/2296** (2013.01); **C08L 2205/02** (2013.01)

(58) **Field of Classification Search**

CPC .. **C08J 3/203**; **C08J 3/226**; **C08K 3/04**; **C08K 3/22**; **C08K 3/36**; **C08K 9/02**; **C08L 7/02**; **C08L 9/10**

See application file for complete search history.

(56) **References Cited**

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Primary Examiner — Edward J Cain

(57)

ABSTRACT

Methods to prepare elastomer compounds are described that include dry mixing at least one additive to an elastomer composite masterbatch at low temperatures over a shortened mixing cycle with reduced energy consumption. The elastomer composite masterbatch is produced in a liquid masterbatch process. The resulting elastomer compounds are further described as well as property improvements that can be achieved.

16 Claims, 2 Drawing Sheets



US011427557B2

(12) **United States Patent**
Shakhnovich et al.

(10) **Patent No.:** **US 11,427,557 B2**
(45) **Date of Patent:** **Aug. 30, 2022**

(54) **SYNERGISTS FOR QUINACRIDONE
MAGENTA PIGMENTS**

(71) Applicant: **Cabot Corporation**, Boston, MA (US)

(72) Inventors: **Alexander I. Shakhnovich**, Arlington,
MA (US); **Heather E. Clarke**,
Lancaster, MA (US)

(73) Assignee: **Cabot Corporation**, Boston, MA (US)

(*) Notice: Subject to any disclaimer, the term of this
patent is extended or adjusted under 35
U.S.C. 154(b) by 274 days.

(21) Appl. No.: **16/887,135**

(22) Filed: **May 29, 2020**

(65) **Prior Publication Data**

US 2020/0377470 A1 Dec. 3, 2020

Related U.S. Application Data

(60) Provisional application No. 62/854,524, filed on May
30, 2019.

(51) **Int. Cl.**

C07D 401/04 (2006.01)

C07D 401/14 (2006.01)

C09D 11/322 (2014.01)

(52) **U.S. Cl.**

CPC **C07D 401/04** (2013.01); **C07D 401/14**
(2013.01); **C09D 11/322** (2013.01)

(58) **Field of Classification Search**

CPC C07D 401/04; C07D 401/14

USPC 106/31.77

See application file for complete search history.

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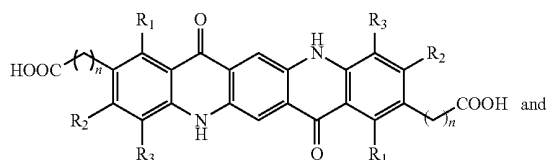
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Primary Examiner — Niloofar Rahmani

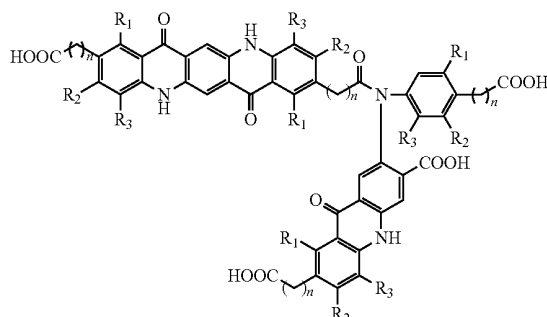
(57) **ABSTRACT**

Disclosed herein are compositions (e.g., pigment dispersions
or ink compositions such as inkjet ink compositions) com-
prising at least one quinacridone magenta pigment and at
least one synergist selected from compounds (A) and (B)
having the following structures, wherein each n is an integer
independently ranging from 1 to 4, and R₁-R₃ are each
independently selected from H, CH₃, Cl, and F,

(A)



(B)



18 Claims, No Drawings



US011352465B2

(12) **United States Patent**
Chen et al.

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(45) **Date of Patent: Jun. 7, 2022**

(54) **ELASTOMER COMPOUNDS**

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patent is extended or adjusted under 35
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10, 2016.

(51) **Int. Cl.**

C08J 3/22 (2006.01)

C08K 3/04 (2006.01)

C08J 3/21 (2006.01)

C08L 9/02 (2006.01)

C08L 27/16 (2006.01)

(52) **U.S. Cl.**

CPC **C08J 3/226** (2013.01); **C08J 3/21**
(2013.01); **C08K 3/04** (2013.01); **C08K 3/042**
(2017.05); **C08L 9/02** (2013.01); **C08L 27/16**
(2013.01); **C08J 2307/00** (2013.01); **C08J**
2309/02 (2013.01); **C08J 2311/00** (2013.01);
C08J 2327/12 (2013.01); **C08J 2327/20**
(2013.01); **C08J 2427/20** (2013.01); **C08K**
2201/006 (2013.01); **C08K 2201/011**
(2013.01); **C08K 2201/014** (2013.01)

(58) **Field of Classification Search**

CPC . C08J 3/21; C08J 3/226; C08J 2427/20; C08J
2327/12; C08J 2311/00; C08J 2309/02;

C08J 2307/00; C08J 2327/20; C08K
3/042; C08K 3/04; C08K 2201/011;
C08K 2201/014; C08K 2201/006; C08L
9/02; C08L 27/16

See application file for complete search history.

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Primary Examiner — Angela C Scott

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ABSTRACT

Disclosed herein are elastomer compounds comprising: at
least one elastomer that is resistant to heat for 70 h at 100°
C. such that the at least one elastomer exhibits at least one
of the following properties selected from: (a) a change in
durometer hardness of no more than 15 points, (b) a change
in tensile strength of no more than 40%, and (c) a change in
ultimate elongation of no more than 40% The elastomer
compound further comprises at least one graphene-based
material present in an amount ranging from 0.01 phr to 30
phr relative to the at least one elastomer and at least one
carbon black present in an amount ranging from 15 phr to
150 phr relative to the at least one elastomer. Also disclosed
are methods of making such compounds, and articles com-
prising elastomer compounds.

12 Claims, No Drawings



US011352536B2

(12) **United States Patent**
Villalpando-Paez et al.(10) **Patent No.: US 11,352,536 B2**
(45) **Date of Patent: *Jun. 7, 2022**(54) **THERMALLY CONDUCTIVE POLYMER
COMPOSITIONS CONTAINING CARBON
BLACK**(71) Applicant: **Cabot Corporation**, Boston, MA (US)(72) Inventors: **Federico Villalpando-Paez**, San Francisco, CA (US); **George D. Eid**, Nashua, NH (US); **Alyson M. Christopher**, San Jose, CA (US); **Mark J. Hampden-Smith**, Chelmsford, MA (US); **Santiago Pierre**, Liege (BE); **Alain Thielen**, Thimister (BE); **Limeng Chen**, Arlington, MA (US); **Agathagelos Kyrlidis**, Cambridge, MA (US); **Bruce E. MacKay**, Framingham, MA (US)(73) Assignee: **Cabot Corporation**, Boston, MA (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 27 days.

This patent is subject to a terminal disclaimer.

(21) Appl. No.: **16/073,820**(22) PCT Filed: **Jan. 25, 2017**(86) PCT No.: **PCT/US2017/014839**

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C08J 3/22 (2013.01); **C08K 3/04** (2013.01);
C08K 3/38 (2013.01); **C08K 2003/385**
(2013.01); **C08K 2201/001** (2013.01); **C09C**
1/48 (2013.01); **C09C 1/56** (2013.01)(58) **Field of Classification Search**CPC **C09K 5/14**; **C09C 1/48**; **C09C 1/56**; **C09C**
1/50; **C08K 3/04**

USPC 252/75; 106/472, 478, 473, 31.9

See application file for complete search history.

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Primary Examiner — Jane L Stanley

(57) **ABSTRACT**

A composite polymer composition comprising partially crystallized carbon black. The composition exhibits superior thermal transfer properties in plastic formulations. The polymer precursor exhibits excellent rheology when compared to similar compositions comprising traditional carbon blacks. The composite polymers provide for higher loading of more thermally conductive carbon blacks in a variety of composite polymer compositions.

11 Claims, 4 Drawing Sheets