

(19) World Intellectual Property
Organization
International Bureau



(43) International Publication Date
17 March 2005 (17.03.2005)

PCT

(10) International Publication Number
WO 2005/023927 A1

(51) International Patent Classification⁷: **C08K 5/12**,
5/11, C08G 18/38, C07C 67/26, 69/80

(21) International Application Number:
PCT/US2004/026826

(22) International Filing Date: 19 August 2004 (19.08.2004)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
10/651,823 29 August 2003 (29.08.2003) US
10/849,680 20 May 2004 (20.05.2004) US

(71) Applicant (for all designated States except US): **ALBEMARLE CORPORATION** [US/US]; 451 Florida Street, Baton Rouge, LA 70801-1765 (US).

(72) Inventors; and

(75) Inventors/Applicants (for US only): **FESKE, Elbert, F.** [US/US]; 1445 Landsdowne Drive, Denham Springs, LA 70726 (US). **CLARK, Nelson, E.** [US/US]; 16151 Indigo Ridge Avenue, Baton Rouge, LA 70817 (US).

MACK, Arthur, G. [GB/US]; 37234 Lake Shore Avenue, Prairieville, LA 70769 (US). **APLIN, Jeffrey, Todd** [US/US]; 5023 front Royal Drive, Baton Rouge, LA 70817 (US).

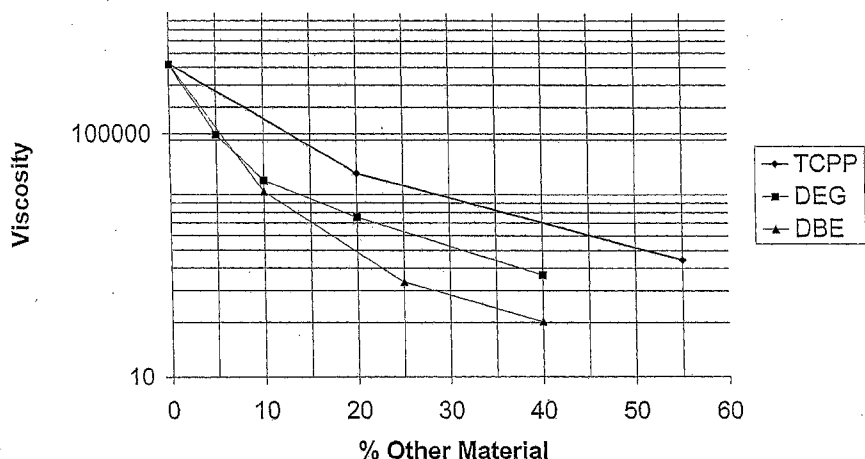
(74) Agents: **SPIELMAN, Edgar, E., Jr.** et al.; Albemarle Corporation, Law Dept., 451 Florida Street, Baton Rouge, LA 70801-1765 (US).

(81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, 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, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NA, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, 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, IT, LU, MC, NL, PL, PT, RO, SE, SI,

[Continued on next page]

(54) Title: FLAME RETARDANTS WITH HIGH HALOGEN CONTENT AND LOW VISCOSITY



(57) Abstract: A flame retardant formulation which is the combination of at least (1) at least one bromine-containing polyol flame retardant formed from the reaction of (a) tetrabromophthalic anhydride, (b) an aliphatic polyol, and (c) an epoxide, and (2) at least one aliphatic diester of an alkane dicarboxylic acid, with the proviso that the formulation has a viscosity at 25°C of about 20,000 cps or less, and a bromine content of at least about 40 wt%. A flame retardant compound formed from A) tetrabromophthalic anhydride; B) diethylene glycol; C) at least one alpha-omega alkane diol, or at least one alpha-omega alkane diol and at least one aliphatic monool; and D) at least one alkylene oxide; with the proviso that the compound has a viscosity at 25°C of about 60,000 cps or less, and a bromine content of at least about 43 wt%. Polymer compositions formed from (a) a polyurethane or a polyisocyanurate and (b) a formulation of the invention. One process to make a formulation involves heating a mixture of (a), (b), and at least one liquid aliphatic diester of an alkane dicarboxylic acid to form an intermediate composition; and then the intermediate is contacted one or more times with (c) thereby producing the formulation. Optionally, excess (c) is removed.

WO 2005/023927 A1



SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Declarations under Rule 4.17:

- *as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii)) for the following designations* AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, 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, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NA, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, UZ, VC, VN, YU, ZA, ZM, ZW, ARIPO patent (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IT, LU, MC, NL, PL, PT, RO, SE, SI, SK, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG)
- *as to the applicant's entitlement to claim the priority of the earlier application (Rule 4.17(iii)) for the following designations* AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, 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, HR, HU, ID,

IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NA, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, UZ, VC, VN, YU, ZA, ZM, ZW, ARIPO patent (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IT, LU, MC, NL, PL, PT, RO, SE, SI, SK, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG)

Published:

- *with international search report*

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.