

(19) World Intellectual Property Organization
International Bureau



(43) International Publication Date
2 May 2008 (02.05.2008)

PCT

(10) International Publication Number
WO 2008/051241 A3

(51) International Patent Classification:
C08F 8/00 (2006.01) *C08G 69/48* (2006.01)

(21) International Application Number:
PCT/US2006/045088

(22) International Filing Date:
22 November 2006 (22.11.2006)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
60/738,938 22 November 2005 (22.11.2005) US

(71) Applicant (for all designated States except US): **CORNERSTONE RESEARCH GROUP, INC.** [US/US];
2750 Indian Ripple Road, Dayton, OH 45440 (US).

(72) Inventors; and

(75) Inventors/Applicants (for US only): **HREHA, Richard, J.** [US/US]; 2744 C Monterey Circle, Beavercreek, OH 45431 (US). **VINING, Benjamin, John** [US/US]; 1919 Nash Court, Dayton, OH 45439 (US). **SCHUELER, Robert, M.** [US/US]; 30 County Manor Lane, Apt. H, Centerville, OH 45458 (US). **NICKERSON, David** [US/KR]; Yale Foreign Language Academy, Jujudo Seog-wipsi Seohongdong 441-3, Jeju 697-080 (KR).

(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, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LV, LY, MA, MD, ME, 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, 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
- before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments

(88) Date of publication of the international search report:
18 September 2008

(54) Title: SHAPE MEMORY CYANATE ESTER COPOLYMERS

(57) Abstract: This disclosure covers a new methodology to produce high performance, high temperature, thermoset resins having shape memory characteristics based on cyanate ester resins. This methodology is based on pericyclic polycyclotrimerizations by utilizing a heretofore unknown polymerization mechanism based on equilibrium controlled condensation and cyclization. A mono-functional cyanate ester resin is reacted with at least one molecule terminated with a moiety containing an active hydrogen. One example of molecules with a moiety terminated with an active hydrogen are amine terminated dimethylsiloxane. The resulting compound is heated and reacted with a difunctional cyanate ester resin and cured. The T_g of the final Cyanate Ester SMP can be matched to specific requirements by adjusting the ratio of the previous said elements and/or the addition of other agents to adjust the physical properties of the final Cyanate Ester SMP.



WO 2008/051241 A3

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US 06/45088

A. CLASSIFICATION OF SUBJECT MATTER

IPC(8) - C08F 8/00 (2008.04), C08G 69/48 (2008.04)

USPC - 525/100; 525/420

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

USPC: 525/100; 525/420

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

US WEST(PGPB,USPT,EPAB,JPAB), Google Scholar, Dialog PRO (Engineering), Patentscope (worldwide)

shape memory polymer, polyisocyanate, polydimethylsiloxane, diamine, diisocyanate, monofunctional isocyanate, silicone, cross-linked

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 2002/0161114 A1 (Gunatillake et al.) 31 October 2002 (31.10.2002) para [0008]-[0030]; para [0037]-[0040], para [0064]-[0065].	1-19
Y	US 5,856,022 A (McCormick et al.) 05 January 1999 (05.01.1999) col 8, ln 15-23; col 9, ln 35; ln 60 to col 10, ln 8.	1-19

☐ Further documents are listed in the continuation of Box C.

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search

11 July 2008 (11.07.2008)

Date of mailing of the international search report

17 JUL 2008

Name and mailing address of the ISA/US

Mail Stop PCT, Attn: ISA/US, Commissioner for Patents

P.O. Box 1450, Alexandria, Virginia 22313-1450

Facsimile No. 571-273-3201

Authorized officer:

Lee W. Young

PCT Helpdesk: 571-272-4300

PCT OSP: 571-272-7774