

US009944789B2

(12) United States Patent Bilodeau et al.

(54) POLYMERIC COMPOSITE MATERIALS AND METHODS OF MAKING THEM

(71) Applicant: University of Maine System Board of Trustees, Bangor, ME (US)

(72) Inventors: **Michael A. Bilodeau**, Brewer, ME (US); **Jonathan Spender**, Enfield, ME

(US)

(73) Assignee: University of Maine System Board of Trustees, Bangor, ME (US)

*) Notice: Subject to any disclaimer, the term of this

(*) 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.: 14/894,120

(22) PCT Filed: May 30, 2014

(86) PCT No.: PCT/US2014/040268

§ 371 (c)(1),

(2) Date: Nov. 25, 2015

(87) PCT Pub. No.: **WO2014/194215**

PCT Pub. Date: Dec. 4, 2014

(65) Prior Publication Data

US 2016/0102201 A1 Apr. 14, 2016

Related U.S. Application Data

- (60) Provisional application No. 61/829,395, filed on May 31, 2013.
- (51) Int. Cl. C08L 67/04 (2006.01) C08L 67/02 (2006.01) (Continued)

(Continued)

(10) Patent No.: US 9,944,789 B2

(45) **Date of Patent:** Apr. 17, 2018

(58) Field of Classification Search

CPC .. C08L 67/04; C08L 1/02; C08L 67/02; C08L 2205/16; C08K 3/34; C08K 3/346; C08K 3/30; C09D 167/04

See application file for complete search history.

(56) References Cited

U.S. PATENT DOCUMENTS

6,337,131	B1*	1/2002	Rupaner B05D 5/061
			428/212
6,632,894	B1 *	10/2003	McDaniel B01J 21/16
			502/118

(Continued)

FOREIGN PATENT DOCUMENTS

CN 103044911 A 4/2013 EP 0955323 A1 11/1999

OTHER PUBLICATIONS

Sigma-Aldrich ethylene glycol data sheet. Obtained from http://www.sigmaaldrich.com/catalog/product/sial/324558?lang=en ®ion=US on Dec. 28, 2016. No Author, No date.*

(Continued)

Primary Examiner — Michael A Salvitti (74) Attorney, Agent, or Firm — Choate Hall & Stewart, LLP; Brian E. Reese; Margo R. Monroe

(57) ABSTRACT

Disclosed are processes for making polymeric composite materials and composite materials made from those processes the process comprising: providing a mixture, comprising: a liquid, a polymer precursor, and a dispersed-phase precursor; and subjecting the mixture to reaction conditions sufficient: to effect polymerization of the polymer precursor to produce a polymer and a reaction product; and to remove substantially all the liquid and reaction product from the mixture; wherein said reaction conditions comprise: pressure between about 10 millitorr and about 300 torr; and temperature: greater than or equal to the highest boiling point of the liquid and reaction product; less than the (Continued)

