Progress in Polymer Science 57 (2016) 32–63

Contents lists available at ScienceDirect

Progress in Polymer Science

journal homepage: www.elsevier.com/locate/ppolysci

Advances in healing-on-demand polymers and polymer composites

Pengfei Zhang[a], Guoqiang Li[a,b,*]

[a] Department of Mechanical & Industrial Engineering, Louisiana State University, Baton Rouge, LA 70803, USA
[b] Department of Mechanical Engineering, Southern University, Baton Rouge, LA 70813, USA

ARTICLE INFO

Article history:
Received 1 December 2014
Received in revised form 21 August 2015
Accepted 19 November 2015
Available online 6 January 2016

Keywords:
Healing-on-demand
Polymers
Polymer composites
Biomimetic
Close-then-heal
Shape memory

ABSTRACT

Healing-on-demand materials exhibit the capability to close cracks and heal the closed/narrowed cracks when needed and to recover functionality using intrinsic or extrinsic resources. In this paper, advances in healing-on-demand polymers and polymer composites in the past decade are reviewed, covering different schemes and technologies used to trigger crack closure and to heal molecularly. A balanced review on non-load-bearing polymers and polymer composites as well as load-carrying polymers and polymer composites is presented. The progress in self-healing polymers and polymer composites has been well discussed recently in the literatures. In this review, therefore, less attention has been paid on what has been widely reported; we primarily focus on healing-on-demand materials concerned with large volume damage healing by a close-then-heal (CTH) strategy. The healing-on-demand material by the CTH approach undergoes a process of crack closure, followed by crack healing with healing agents. Healing theories, including those within the continuum damage mechanics framework, and healing efficiency evaluations are also reviewed. Perspectives on future development in this emerging research area are discussed.

© 2015 Elsevier Ltd. All rights reserved.

Contents

* Corresponding author at: Department of Mechanical & Industrial Engineering, Louisiana State University, Baton Rouge, LA 70803, USA. Tel.: +1 225 578 5302.
E-mail address: lguoqi1@lsu.edu (G. Li).

http://dx.doi.org/10.1016/j.progpolymsci.2015.11.005
0079-6700/© 2015 Elsevier Ltd. All rights reserved.

Nomenclature

A6ACA	acryloyl-6-aminocaproic acid
β-CD	β-cyclodextrin
BDMA	benzyl dimethylamine
BIE	benzoin isobutyl ether
bPEI	branched poly(ethylenimine)
BPO	benzoyl peroxide
CDTE	cyanodithioester
CoPECs	compact polyelectrolyte complexes
Cp	cyclopentadiene
CuAAC	copper (I)-catalyzed alkyne-azide cycloaddition
DA	Diels–Alder reaction
DABBF	diarylbibenzofuranone
DB24C8	dibenzo[24]crown-8
DBTL	di-*n*-butyltin dilaurate
DCPD	dicyclopentadiene
DHEOMC	derivative 5,7-bis(2-hydroxyethoxy)-4-methylcoumarin
DNA	deoxyribonucleic acid
DOPA	3,4-dihydroxyphenylalanine
DTHP	diglycidyl tetrahydro-o-phthalate
EMNa	sodium salt of poly(ethyelene-*co*-methacrylic acid)
EMZn	zinc salt of poly(ehtyelene-*co*-methacrylic acid)
ENR	epoxidized natural rubber
GMA	glycidyl methacrylate
HGF	hollow glass fiber
HOPDMS	hydroxyl end-functionalized poly-dimethylsiloxane
HPA	2-hydroxypropyl acrylate
HPF	hollow polymer fiber
IPDI	isophorone diisocyanate
LMWOs	low-molecular-weight organogelators
M_2	1,8-Bis(maleimido)-triethylene glycol
MAT	methacryloxypropyl-terminated
NHCs	N-heterocyclic carbenes
PA	polyacrylate
PAA	poly(acrylic acid)
pAA-CDs	poly(acrylic acid) modified with cyclodextrins
pAA-Fc	poly(acrylic acid) modified with ferrocene
PAH	poly(allylamine hydrochloride)
PCL	poly(ε-caprolactone)
PDMAA	poly(N,N-dimethylacrylamide)
PDMS	poly(dimethylsiloxane)
PEG	poly(ethylene glycol)
PEI	poly(ethyleneimine)
PEMAA	poly(ethylene-co-methacrylic acid)
PFS	poly(2,5-furandimethylene succinate)
PIB	poly(isobutylene)
PIE	isonicotinate-functionalized polyesters
PK	polyketones
PLA	poly(lactic acid)
PMMA	poly(methyl methacrylate)
PNIPA	poly(N-isopropylacrylamide)
PISP	polyisoprene
POM	polyoxometalates
PVAc	poly(vinyl acetate)
PVA	poly(vinyl alcohol)
PS	polystyrene
PSS	poly(styrene sulfonate)
rDA	reversible Diels–Alder reaction
ROMP	ring-opening metathesis polymerization
SMA	shape memory alloy
SMP	shape memory polymer
TDCB	tapered double cantilever beam
TDI	2,4-toluene diisocyanate
TDS	thiuram disulfide
TfOH	trifluoromethanesulfonic acid
TPU	thermoplastic polyurethane
TTC	trithiocarbonate
UPy	ureidopyrimidinone
VI	N-vinylimidazole

Download English Version:

https://daneshyari.com/en/article/5207955

Download Persian Version:

https://daneshyari.com/article/5207955

Daneshyari.com