

Hot Articles

“May|2017”

Science & Technology



Title: [Graphene as initiator/catalyst in polymerization chemistry](#)

Author: Ali Shaygan Nia, Wolfgang H. Binder

Journal: Progress in Polymer Science

Volume: 67 **Issue:** - **Page:** 48–76

Doi: 10.1016/j.progpolymsci.2016.12.005

Abstract

One of the most important applications of graphene-based materials is the formation of nanocomposite materials, where graphene in the bulk-polymer matrix transfers its properties onto the polymeric material. Control of the polymer/graphene interface by attached polymeric interlayers is essential to generate nanocomposites, thus avoiding the aggregation of graphene nanoparticles. Among all graphene materials graphene oxide (GO) and reduced graphene oxide (r-GO) can be prepared on large scales useful for mass production graphene/polymer composites. The direct use of graphene materials as both, the polymerization initiator or catalyst and additive not only diminishes the agglomeration of particles in composites but also reduces the process of composite production to one facile step, which in turn avoids further purification regarding to strong acid initiators and metal particles catalysts. Here, literature activities within the past ~ 10 years using graphene-based materials either as initiator or catalyst in different polymerization reactions are reviewed.

Database

ScienceDirect

Title: [Functionalization of carbon nanomaterials for advanced polymer nanocomposites: A comparison study between CNT and graphene](#)

Author: Vinay Deep Punetha, Sravendra Rana, Hye Jin Yoo, Alok Chaurasia, James T. McLeskey Jr., Madeshwaran Sekkarapatti Ramasamy, Nanda Gopal Sahoo, Jae Whan Cho

Journal: Progress in Polymer Science

Volume: 67 **Issue:** - **Page:** 1–47

Doi: 10.1016/j.proppolymsci.2016.12.010

Abstract

The allotropes of carbon nanomaterials (carbon nanotubes, graphene) are the most unique and promising substances of the last decade. Due to their nanoscale diameter and high aspect ratio, a small amount of these nanomaterials can produce a dramatic improvement in the properties of their composite materials. Although carbon nanotubes (CNTs) and graphene exhibit numerous extraordinary properties, their reported commercialization is still limited due to their bundle and layer forming behavior. Functionalization of CNTs and graphene is essential for achieving their outstanding mechanical, electrical and biological functions and enhancing their dispersion in polymer matrices. A considerable portion of the recent publications on CNTs and graphene have focused on enhancing their dispersion and solubilization using covalent and non-covalent functionalization methods. This review article collectively introduces a variety of reactions (e.g. click chemistry, radical polymerization, electrochemical polymerization, dendritic polymers, block copolymers, etc.) for functionalization of CNTs and graphene and fabrication of their polymer nanocomposites. A critical comparison between CNTs and graphene has focused on the significance of different functionalization approaches on their composite properties. In particular, the mechanical, electrical, and thermal behaviors of functionalized nanomaterials as well as their importance in the preparation of advanced hybrid materials for structures, solar cells, fuel cells, supercapacitors, drug delivery, etc. have been discussed thoroughly.

Database

ScienceDirect

Title: [Stereochemical Aspects of Polyphosphazenes](#)
Author: Serkan Yeşilot & Aylin Uslu
Journal: Polymer Reviews
Volume: 57 **Issue:** 2 **Page:** 213-247
Doi: 10.1080/15583724.2016.1191023

Abstract

Polyphosphazenes are the most important class of inorganic polymers having a backbone of alternating phosphorus and nitrogen atoms with phosphorus atoms bearing organic, inorganic or organometallic side groups. They are potentially optically active macromolecules because they may have a center of chirality anywhere in their structure. Although there have been a number of studies which deal with the polyphosphazenes having stereogenic P-moieties in the main chain, chiral groups in the side chain, optically active helical structure, and cycloliner phosphazene polymers for over the last fifty years, there is little emphasis on the stereochemistry of phosphazene polymers to date. In this review the polyphosphazenes containing centers of chirality P- and/or C-moieties anywhere in their structure have been covered.

Database

Taylor & Francis Journals

Title: [Biocidal Polymers: A Mechanistic Overview](#)
Author: Ao Chen, Hui Peng, Idriss Blakey & Andrew K. Whittaker
Journal: Polymer Reviews
Volume: 57 **Issue:** 2 **Page:** 276-310
Doi: 10.1080/15583724.2016.1223131

Abstract

Bacterial fouling on surfaces is considered a major problem in modern society. Conventional methods to prevent biofilm formation often have little effect and may induce further contamination. In response to this challenge, biocidal polymers have been designed and applied as an alternative approach to kill or inhibit bacteria and prevent the formation of biofilm. These polymers can be grouped into three broad classes, namely antibiotic-releasing polymers, polymeric antibiotics, and antibiotic polymers. Antibiotic polymers are effective against bacteria both in solution and as coatings, through different mechanisms of action. In order to enhance their efficacy, biocidal polymers have been designed with single or combined biocidal and antibiofouling actions. The current review summarizes the mechanisms of action of biocidal polymers, especially antibiotic polymers, both in solution and as coatings. The review also discusses biocidal polymers with multiple functionalities.

Database

Taylor & Francis Journals

Title: [A Review on Rubber-Enhanced Polymeric Materials](#)
Author: Eugene B. Caldon, Al Christopher C. De Leon, Bryan B. Pajarito & Rigoberto C. Advincula
Journal: Polymer Reviews
Volume: 57 **Issue:** 2 **Page:** 311-338
Doi: 10.1080/15583724.2016.1247102

Abstract

In the field of nanotechnology, the innovation of polymer nanocomposites (PNCs) is a fast developing interdisciplinary field which is becoming beneficial to many industries because of the resulting tremendous expansion on the uses of polymers. Despite the enhancement of many of their interesting properties, the potential use of PNCs is yet restricted by an unevenness in mechanical properties; thus, the need for rubber modification. Although studies on rubber-modified polymers and composites were extensively covered in many literatures, not so much has been reported on rubber-modified based PNC systems. This paper is an effort to collect and review pertinent information from past and current developments in polymer matrix-based systems with rubber, of any size, as the main key modification. Also, in the discussion, nanoadditives such as graphene oxide, carbon nanotube, nanoclay, and the like (but not rubber nanoparticles) make a material a nanocomposite. Based on the reviewed studies, rubber-modified PNCs have resulted to enhanced fracture toughness with accompanied but tolerable reduction in material strength and stiffness. With balance end use performance, it is thought that rubber-modified PNCs may lead to more exciting robust materials that amalgamate the power of rubber-toughening and the perks of PNCs.

Database

Taylor & Francis Journals

Title: [Structure-Based Nanocarrier Design for Protein Delivery](#)

Author: Xu Wang, Changying Shi, Li Zhang, Mei Yun Lin, Dandan Guo, Lili Wang, Yan Yang, Thomas M. Duncan, and Juntao Luo

Journal: ACS Macro Letters

Volume: 6 **Issue:** 3 **Page:** 267–271

Doi: 10.1021/acsmacrolett.6b00982

Abstract

Structure-based nanocarrier design for protein delivery remains challenging and has rarely been documented in the literature. We herein present a facile computer-aided approach for rational and customized design of a unique linear–dendritic telodendrimer that self-assembles into a nanocarrier for therapeutic protein delivery, e.g., insulin. Virtual screening of a small-molecule library was performed to identify optimal protein binding moieties, which were conjugated precisely in the telodendrimer backbone preinstalled with charged moieties. We systematically tested our hypothesis and obtained significant correlations between the computational predictions and experimental results. The d- α -tocopherol (vitamin E)-containing nanocarrier showed strong binding affinity for insulin in both computational prediction and experiments, which led to improved blood glucose control. This study affirms the concept and validates the approach of structure-based nanocarrier design for protein delivery.

Database

American Chemical Society Journal (ACS)

Title: [Thermoreversible Gelation of Poly\(ether ether ketone\)](#)

Author: Samantha J. Talley, Xijing Yuan, and Robert B. Moore

Journal: ACS Macro Letters

Volume: 6 **Issue:** 3 **Page:** 262–266

Doi: 10.1021/acsmacrolett.7b00109

Abstract

Solutions of poly(ether ether ketone) in dichloroacetic acid have been shown to form monolithic, thermoreversible gels at temperatures ranging from 10 to 140 °C. A phase diagram was constructed over broad concentration and temperature ranges, and the phase boundary suggests an upper critical solution temperature (UCST) behavior. Furthermore, poly(ether ether ketone) (PEEK) gels were solvent-exchanged with water to form hydrogels and subsequently lyophilized to form PEEK aerogels. The PEEK aerogels of density 0.2 g/mL were found to be highly porous and composed of uniform 200 nm morphological features. The crystal structure of the PEEK hydrogels and aerogels was found to be identical to that of melt-crystallized PEEK. The mechanical properties of the PEEK aerogels (in compression) were found to be superior to conventional silicate aerogels of comparable density. This report is the first example of a monolithic, thermoreversible gel of PEEK and the first demonstration of PEEK hydrogels and aerogels.

Database

American Chemical Society Journal (ACS)

Title: [Polyphosphoramidates That Undergo Acid-Triggered Backbone Degradation](#)
Author: Hai Wang, Lu Su, Richen Li, Shiyi Zhang, Jingwei Fan, Fuwu Zhang, Tan P. Nguyen, and Karen L. Wooley
Journal: ACS Macro Letters
Volume: 6 **Issue:** 3 **Page:** 219–223
Doi: 10.1021/acsmacrolett.6b00966

Abstract

The direct and facile synthesis of polyphosphoramidates (PPAs) with acid-labile phosphoramidate backbone linkages are reported, together with demonstration of their hydrolytic degradability, evaluated under acidic conditions. The introduction of acid-labile linkages along the polymer backbone led to rapid degradation of the polymer backbone dependent upon the environmental stimuli. An oxazaphospholidine monomer bearing a phosphoramidate linkage was designed and synthesized to afford the PPAs via organobase-catalyzed ring-opening polymerization in a controlled manner. The hydrolytic degradation of the PPAs was studied, revealing breakdown of the polymer backbone through cleavage of the phosphoramidate linkages under acidic conditions.

Database

American Chemical Society Journal (ACS)

Title: [A new fluoropyrido\[3,4-b\]pyrazine based polymer for efficient photovoltaics](#)

Author: Tao Wang, Lihui Jiang, Jun Yuan, Liuliu Feng, Zhi-Guo Zhang, Jiannan Xiang, Yongfang Li and Yingping Zou

Journal: Polymer Chemistry

Volume: - **Issue:** 14 **Page:** 2227-2234

Doi: 10.1039/C7PY00349H

Abstract

In order to improve the photovoltaic performance of pyrido[3,4-b]pyrazine (PP)-based polymers, a new fluoropyrido[3,4-b]pyrazine based D–A type polymer (BDT-S-fPP) was synthesized. The optical, electrochemical and photovoltaic properties were well investigated. A power conversion efficiency (PCE) over 6.0% with a single junction device was obtained, which is the highest PCE among the PP-based polymers reported to date.

Database

RSC

Title: [Bio-inspired strategy for controlled dopamine polymerization in basic solutions](#)

Author: Xin Du, Linxian Li, Farid Behboodi-Sadabad, Alexander Welle, Junsheng Li, Stefan Heissler, Huijie Zhang, Nicolas Plumeré and Pavel A. Levkin

Journal: Polymer Chemistry

Volume: - **Issue:** 14 **Page:** Page

Doi: 10.1039/C7PY00051K

Abstract

Polydopamine (PD) coatings, inspired by the adhesive behavior of the mussel foot, have attracted a lot of attention because of the simplicity, generalizability, and the capability for their secondary modification. However, many possible applications of PD coatings cannot be realized due to the difficulty in controlling dopamine polymerization under basic conditions. Here, we report a new method for the light-triggered control of both the onset and termination of dopamine polymerization under basic conditions. We demonstrate that dopamine polymerization in basic solutions can be efficiently inhibited by adding small quantities of sodium ascorbate (vitamin C) that reduces reactive dopamine quinone and delays dopamine polymerization. UV irradiation of this solution, however, leads to instantaneous dopamine polymerization, thereby making light-driven spatial and temporal control of dopamine polymerization under basic conditions possible. This method is inspired by the antioxidant role of vitamin C in the human body. The mechanism of the light-driven SA-controlled dopamine polymerization has been studied using spectroscopic and electroanalytical methods. By this new method we can control dopamine polymerization without changing the commonly used conditions for the formation of PD coatings, making this method compatible with all existing applications for PD coatings.

Database

RSC