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Foreword

When Harry Met Sally: Polymer Chemistry Meets Biomaterials

Gregory T. Russell, Martina H. Stenzel

Aust. J. Chem. **2006**, *59*, 477–480.

The future is biomacromolecular. The RACI Polymer Division and the Australasian Society for Biomaterials combined their February 2006 conferences into an integrated program, the highlights of which are presented in this Special Issue.

Essay

Stem Cells Need Chemical Solutions

Graham C. Parker

Aust. J. Chem. **2006**, *59*, 481–484.

Stem cell research finds itself at a critical juncture having over-borrowed financially, emotionally, and ethically on the promise and potential that has thus far gone substantially unrealized. Chemical science has technology and expertise that can solve some of the biologists' shortcomings. Recruiting chemical scientists to collaborate with stem cell biologists will advance significantly efforts to understand normal development and achieve therapeutic applications.

Reviews

Chemiluminescence as a Probe of Polymer Oxidation

Idriss Blakey, Ben Goss, Graeme George

Aust. J. Chem. **2006**, *59*, 485–498.

The prediction of the safe service lifetime of polymers in the environment requires sensitive methods such as chemiluminescence (CL) for detecting the chemical changes in the earliest stages of oxidation. CL imaging studies have shown that a mechanism of stochastic spreading of oxidation, like an infection through a population, is a more appropriate kinetic model than classical homogeneous free radical kinetics. Modelling of this spreading combined with CL studies enable new failure criteria to be determined for polypropylene.

Prediction of the Phase Behaviour of Hydrogen-Bonded Polymer Blends

Michael M. Coleman, Paul C. Painter

Aust. J. Chem. **2006**, *59*, 499–507.

Many polymeric materials used today are composed of mixtures of two or more high molecular weight polymers (plus numerous other low molecular weight additives, fibres, fillers, etc., including perhaps the kitchen sink!). Accordingly the science behind the mixing of polymers, and the prediction of the phase behaviour of polymer blends, remains important subjects of interest not only to academics but also to plastics manufacturers. Here we show the phase behaviour of hydrogen-bonded polymer blends can be successfully predicted using equilibrium constants determined from appropriate low molecular weight analogues, if chain connectivity effects such as intermolecular screening and functional group accessibility are included.

Polymer Chemistry in Diabetes Treatment by Encapsulated Islets of Langerhans: Review to 2006

Igor Lacík

Aust. J. Chem. **2006**, *59*, 508–524.

Diabetes becomes a disease with devastating consequences if blood glucose levels (BGLs) are insufficiently controlled. Transplantation of the insulin-producing pancreatic cells, protected from the immune system by a semipermeable membrane, is considered to be a highly promising way for the long-term normalization of BGLs in diabetic patients. This review describes the key role of polymer chemistry in designing the semipermeable membrane with required properties based on a critical discussion of current situation and perspectives for the near future.

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Current Chemistry

Carving out Niches for Nanostructures: Implementation and Interplay of Building Blocks, Methods, and Tools

Eva Harth, Teresa A. Croce

Aust. J. Chem. **2006**, *59*, 525–533.

Well-defined polymeric architectures, created using a diverse array of techniques, mimic the sophistication and diversity of biological materials. Reviewed herein are some of the most active areas for transforming simple polymeric building blocks into a specialized product.

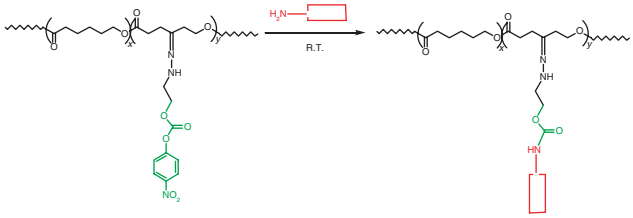
Communications

Coupling Hydrophilic Amine-Containing Molecules to the Backbone of Poly(ε-Caprolactone)

Emma L. Prime, Justin J. Cooper-White, Greg G. Qiao

Aust. J. Chem. **2006**, *59*, 534–538.

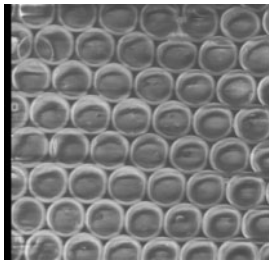
Adding biological functionality to biodegradable polymers for use in tissue engineering and bioactive surfaces is an exciting area of intense interest. A poly(ε-caprolactone) (PCL) based biodegradable polymer containing robust, amine-reactive side chains has been synthesized. The amine-specific reactive side chains allows for the coupling of un-modified amine-containing molecules such as poly(L-lysine) to PCL to occur under mild conditions in the presence of other un-protected functional groups.



Gold-Loaded Organic/Inorganic Nanocomposite Honeycomb Membranes

Kok Hou Wong, Thomas P. Davis, Christopher Barner-Kowollik, Martina H. Stenzel

Aust. J. Chem. **2006**, *59*, 539–543.



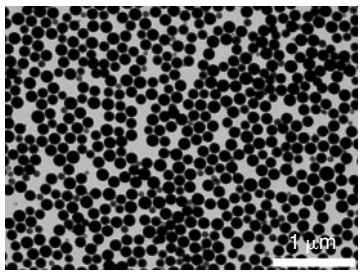
Noble metal nanocomposites often exhibit interesting optoelectronic properties. Amphiphilic block copolymer self-assembly, metal loading and reduction, and the breath figures technique are combined here to create gold-loaded micelles and honeycomb membranes.

Full Papers

Miniemulsion Polymerization Stabilized by a Well-Defined, Amphiphilic Gradient Poly(styrene-*co*-acrylic acid) Copolymer

Catherine Lefay, Maud Save, Bernadette Charleux, Stéphanie Magnet

Aust. J. Chem. **2006**, *59*, 544–548.

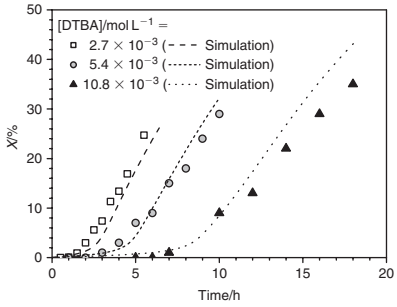


The title copolymer, synthesized by nitroxide-mediated controlled free-radical polymerization, is used as the sole stabilizer in miniemulsion polymerization. Amounts as low as 3% efficiently stabilize 45 wt.-% solids content latexes in a single batch polymerization step, and affords latexes with narrow particle size distribution (shown) with proper choice of radical initiator.

On the Mechanism of Radical Polymerization of Methyl Methacrylate with Dithiobenzoic Acid as Mediator

Duc Hung Nguyen, Philipp Vana

Aust. J. Chem. **2006**, *59*, 549–559.

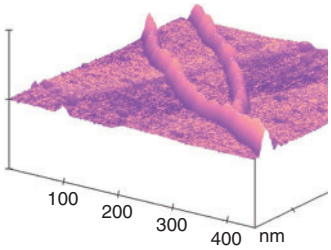


Dithiobenzoic acid induces controlled polymerization behaviour in radical polymerization. The mechanism and kinetics of the reaction sequence that occurs in the initial (induction) period of methyl methacrylate polymerization and which leads to the formation of a reversible addition–fragmentation chain transfer agent is elucidated. Based on kinetic simulations a new polymerization protocol is introduced, by which the significant induction periods in the reaction rate can effectively be eliminated.

AFM Studies on β-Sheet Block Copolymers at Solid Surfaces: High-Resolution Structures and Aggregation Dynamics

Peter Schön, Jurgen M. Smeenk, Sylvia Speller, Hans A. Heus, Jan C. M. van Hest

Aust. J. Chem. **2006**, *59*, 560–563.

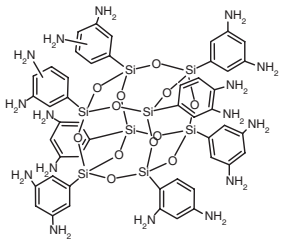


High-resolution, tapping-mode atomic force microscope images of the title compound showed a structure of stable fibres with a tendency to align. Processes of fibre alignment and growth were observed. Such fibrous structures may be useful scaffolds for the attachment of bioactive moieties at the β-turn positions.

New Aminophenylsilsesquioxanes—Synthesis, Properties, and Epoxy Nanocomposites

Kunio Takahashi, Santy Sulaiman, Joshua M. Katzenstein, Stephanie Snoblen, Richard M. Laine

Aust. J. Chem. **2006**, *59*, 564–570.

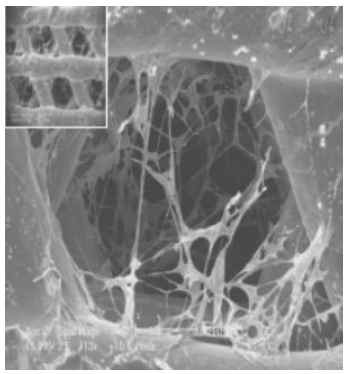


Aminophenylsilsesquioxanes DAPS and HDAPS (shown), synthesized from dodecaphenylsilsesquioxane and octaaminophenylsilsesquioxane, were prepared and characterized. The higher thermal stabilities of HDAPS/epoxy and OAPS/epoxy nanocomposites are caused by higher crosslink densities in OAPS.

Effect of Collagen I-Modified Composites on Proliferation and Differentiation of Human Alveolar Osteoblasts

Yefang Zhou, Dietmar W. Hutmacher, Sae-Lim Varawan, Tit Meng Lim

Aust. J. Chem. **2006**, *59*, 571–578.



Surface modification of biomedical materials could affect biomaterials interaction with cells and the consequent tissue formation. The study was to investigate how collagen type I modification affects human osteoblasts function on composite scaffolds, designed for load-bearing bone defects. The modification improved the scaffold's protein adsorption ability and osteoblasts attachment. However, collagen coating promoted more fibrous-like tissue patterns and less mineralized tissue formation.

Structure–Property and Structure–Function Relations of Leafhopper (*Kahaono montana*) Silk

Jung C. Chang, Geoff M. Gurr, Murray J. Fletcher, Robert G. Gilbert

Aust. J. Chem. **2006**, *59*, 579–585.

An Australian insect, *K. montana*, is the only insect of its type to produce silk. The protein structure and surface molecular properties of this novel silk were investigated to elucidate its biological function. Correlations between the secondary structural conformation and the stretching behaviour of the silk surface revealed that its role is to protect the animal from predators and an adverse environment.

Mechanistic Modelling and Network Properties of Ternary Thiol–Vinyl Photopolymerizations

Sirish K. Reddy, Neil B. Cramer, Michael Kalvaitas, Tai Yeon Lee, Christopher N. Bowman

Aust. J. Chem. **2006**, *59*, 586–593.

Ternary thiol–vinyl polymerizations offer a unique platform for developing polymers with interesting material properties. This study seeks to improve the fundamental understanding of the complex ternary thiol–vinyl systems to enable enhanced control over polymerization kinetics, network evolution, and, ultimately, network properties.