Hybrid Polyurethane Coating Systems Based On Renewable

ROWE HEATH

Polyurethane Polymers: Blends and Interpenetrating Polymer Networks CRC Press
This thesis explored a series of organic-inorganic hybrid polyurethane oligomers with varying molecular weights and functional groups (acrylate and/or silane) that were cured with a single ultraviolet (UV) trigger but two photo-initiators. Upon UV irradiation, the free-radical initiator initiated a free-radical reaction for acrylate cross-linking, and the photo-latent base initiated a sol-gel reaction for condensation of the silanes. This study explored the cure extent of both reactions by FTIR for acrylates and silanes and a weight-loss method for silanes as a function of functional group concentration and time. The general film properties were also studied. The results showed that the free-radical reaction and the sol-gel reaction took simultaneously upon exposure to UV radiation. The extent of the sol-gel reaction was decreased at the presence of acrylate groups. The film properties, like adhesion of the one containing acrylates and silane groups, were increased compared to the system with only acrylate groups.
Coating Materials for Electronic Applications Elsevier
Polyurethane Polymers: Blends and Interpenetrating Networks deals with almost all aspects of blends and IPNs formed by polyurethane, including the thermal, mechanical, morphological, and viscoelastic properties of each blend presented in the book. In addition, major applications related to these blends and IPNs are mentioned. Provides an elaborate coverage of the chemistry of polyurethane, including its synthesis and properties Includes available characterization techniques Relates types of polyurethanes to their potential properties Discusses blends options
Advances in Organic Coatings 2018 Springer
Hybrid organic-inorganic materials and the rational design of their interfaces open up the access to a wide spectrum of functionalities not achievable with traditional concepts of materials science. This innovative class of materials has a major impact in many application domains such as optics, electronics, mechanics, energy storage, and conversion, protective coatings, catalysis, sensing, and nanomedicine. The properties of these materials do not only depend on the chemical structure, and the mutual interaction between their nano-scale building blocks, but are also strongly influenced by the interfaces they share. This handbook focuses on the most recent investigations concerning the design, control, and dynamics of hybrid organic-inorganic interfaces, covering: (i) characterization methods of interfaces, (ii) innovative computational approaches and simulation of interaction processes, (iii) in-situ studies of dynamic aspects controlling the formation of these interfaces, and (iv) the role of the interface for process optimization, devices, and applications in such areas as optics, electronics, energy, and medicine.
Preparation, Properties, Applications William Andrew
Silicon based materials and polymers are made of macromolecular organosilicones. These materials make up products in a variety of industries and products. This book covers the types of silicon-based materials that can be used to make up polymers including POSS, silicones, and organosilicon ligands. This book is ideal for researchers and as such covers the industrial perspective of using each class of material.
Polyester Based Hybrid Organic Coatings Materials Research Society
Polyesters are a class of polymers widely used in organic coatings applications. In this work, four types of organic coatings based on polyester polyols were prepared: UV-curable polyester/poly(meth)acrylate coatings, thermal curable polyester polyurethane-urea coatings, thermal curable non-isocyanate polyurethane coatings, and UV-curable non-isocyanate polyurethane coatings. Polyester/poly(meth)acrylate block copolymers are synthesized using a combination of polycondensation and Atom-Transfer Radical Polymerization (ATRP). All block copolymers are characterized by means of Nuclear Magnetic Resonance (NMR) and Gel Permeation Chromatography (GPC). In the case of unsaturated-polyester-based block copolymers the main chain double bond in the polyester backbone remains almost unaffected during ATRP. The unsaturated block copolymers are crosslinkable and can form networks upon photo-irradiation in the presence of a suitable photoinitiator. These copolymers might be interesting candidates for coatings with better overall properties than those based on neat polyesters. Thermal curable polyester polyol based Polyurethane-Urea (PUU) coatings were formulated using Partially Blocked HDI isocyanurate (PBH), Isophorone Diamine (IPDA), and polyester polyol. As a comparison, the polyurethane coatings (PU) without adding IPDA were also prepared. The mechanical and viscoelastic properties of the PUU and PU coating were investigated by using tensile test and Dynamic Mechanical Thermal Analyzer (DMTA). It was found that PUU coating exhibited higher crosslink density, Tg, tensile modulus and strength than the corresponding PU coating. Thermal curable non-isocyanate polyurethane coatings were prepared by using polyamine and cyclic carbonate terminated polyester. Cyclic carbonate terminated polyester was synthesized from the reaction of the carbon dioxide and epoxidized polyester which was prepared from the polyester polyol. The properties of the epoxidized and cyclic carbonate terminated polyester were characterized by Brookfield viscometer, NMR and Fourier Transform Infrared spectroscopy (FTIR). UV-curable non-isocyanate polyurethane coatings were formulated by using Acrylated Polyester (APE) oligomer and Non-isocyanate Urethane Dimethacrylates (NUDMA) reactive diluents. The effect of the NUDMA on the viscosity of the APE oligomer was investigated by Brookfield viscometer. The photopolymerization kinetics of NUDMA reactive diluents were investigated by the real time FTIR. It was found that the polymerization conversion and maximum polymerization rate increase with increasing initiator concentration in the range from 0.5 % to 4.0 %. The formulation system containing both the APE oligomer and NUDMA reactive dilutes showed higher polymerization overall conversion and maximum polymerization rate than APE oligomer. After UV curing, the viscoelastic, tensile and thermal properties of the cured films were evaluated as a function of the reactive diluent by using DMTA, tensile test, Differential Scanning Calorimeters (DSC), and Thermal Gravimetric Analysis (TGA). In addition, coating properties such as pencil hardness, chemical resistance, impact resistance, and gloss were also investigated. It was found that crosslink density, storage and tensile modulus, pencil hardness, chemical resistance, gel content, total water absorption, and Tg were directly proportional to amount of the reactive diluents. Compared to the commercial Ethylene Glycol Dimethacrylate (EGDMA) reactive diluent, the NUDMA reactive diluents show significant improvements in impact resistance and elongation at break properties.
Sol-Gel Nanocomposites Elsevier
After completing his chemistry studies in Krefeld/ Germany, Wernfried Heilen started working for Wulfing (PPG) in 1977, in the R&D Department for Industrial Coatings. After moving to Byk Chemie, he assumed responsibility as ProductManager for various product groups. In 1983 he joinedGoldschmidt as Head of Technical Service for Additives and, at a later stage, for silicone resins as well. He has been Director of Technical Marketing Department in the Degussa Business Line Tego Coatings & Ink Additives since 2001."
Silicon-Based Hybrid Nanoparticles CRC Press
This first book in the Materials and Processes for Electronics Applications series answers questions vital to the successful design and manufacturing of electronic components, modules, and systems such as: - How can one protect electronic assemblies from prolonged high humidity, high temperatures, salt spray or other terrestrial and space environments? - What coating types can be used to protect microelectronics in military, space, automotive, or medical environments? - How can the chemistry of polymers be correlated to desirable physical and electrical properties? - How can a design engineer avoid subsequent potential failures due to corrosion, metal migration, electrical degradation, outgassing? - What are the best processes that manufacturing can use to mask, clean, prepare the surface,

dispense the coating, and cure the coating? - What quality assurance and in-process tests can be used to assure reliability? - What government or industry specifications are available? - How can organic coatings be selected to meet OSHA, EPA, and other regulations? Besides a discussion of the traditional roles of coatings for moisture and environmental protection of printed circuit assemblies, this book covers dielectric coatings that provide electrical functions such as the low-dielectric-constant dielectrics used to fabricate multilayer interconnect substrates and high-frequency, high-speed circuits. Materials engineers and chemists will benefit greatly from a chapter on the chemistry and properties of the main types of polymer coatings including: Epoxies, Polyimides, Silicones, Polyurethanes, Parylene, Benzocyclobenzene and many others. For manufacturing personnel, there is an entire chapter of over a dozen processes for masking, cleaning, and surface preparation and a comprehensive review of over 20 processes for the application and curing of coatings including recent extrusion, meniscus, and curtain coating methods used in processing large panels. The pros and cons of each method are given to aid the engineer in selecting the optimum method for his/her application. As a bonus, from his own experience, the author discusses some caveats that will help reduce costs and avoid failures. Finally, the author discusses regulations of OSHA, EPA, and other government agencies which have resulted in formulation changes to meet VOC and toxicity requirements. Tables of numerous military, commercial, industry, and NASA specifications are given to help the engineer select the proper callout.

Organic/inorganic Hybrid Materials BoD – Books on Demand

Corrosion Protection at the Nanoscale explores fundamental concepts on how metals can be protected at the nanoscale by using both nanomaterials-based solutions, including nanoalloys, noninhibitors and nanocoatings. It is an important reference resource for both materials scientists and engineers wanting to find ways to create an efficient corrosion prevention strategy. Nanostructure materials have been widely used in many products, such as print electronics, contact, interconnection, implant, nanosensors and display units to lessen the impact of corrosion. Traditional methods for protection of metals include various techniques, such as coatings, inhibitors, electrochemical methods (anodic and cathodic protections), metallurgical design are covered in this book. Nanomaterials-based protective methods can offer many advantages over their traditional counterparts, such as protection for early-stage, higher corrosion resistance, better corrosion control. This book also outlines these advantages and discusses the challenges of implementing nanomaterials as corrosion protection agents on a wide scale. Explains the main methods of detection, monitoring, testing, measurement and simulation of corrosion at the nanoscale Explores how metals can be protected at the nanoscale using nanotechnology and nanomaterials Discusses the major challenges of detecting and preventing corrosion at the nanoscale

Failure Analysis of Paints and Coatings IGI Global

Green nanotechnology has two goals: producing nanomaterials and products without harming the environment or human health, and producing nanoproducts that provide solutions to environmental problems. It uses existing principles of green chemistry and green engineering to make nanomaterials and nanoproducts without toxic ingredients, at low temperatures using less energy and renewable inputs wherever possible, and using lifecycle thinking in all design and engineering stages. The production and process aspects of green nanotechnology involve both making nanomaterials in a more environmentally benign fashion and using nanomaterials to make current chemical processes more environmentally acceptable. This book contains information about advanced nanomaterials that can be produced without harming the environment or human health. This encompasses the production of nanomaterials without environmental toxicity, at room temperature and with the use of renewable energy sources. The book contains the descriptions and results of theoretical and experimental researches in the field of environment friendly nanotechnology carried out over the past decade by the scientific team of company Polymate Ltd.-International Nanotechnology Center (Israel) under leadership of Prof. O. Figovsky. Developments of the Company have been used in industry and agriculture and protected by more than 25 patents of USA, Germany and Russia.

Corrosion Protection at the Nanoscale Springer

Paint coatings remain the most widely used way of protecting steel structures from corrosion. This important book reviews the range of organic paint coatings and how their performance can be enhanced to provide effective and lasting protection. The book begins by reviewing key factors affecting the success of a coating, including surface preparation, methods of application, selecting an appropriate paint and testing its effectiveness. It also discusses why coatings fail, including how they degrade, and what can be done to prevent these problems. Part two describes the main types of coating and how their performance can be enhanced, including epoxies, polyester, glass flake, fluoropolymer, polysiloxane and waterborne coatings. The final part of the book looks at applications of high-performance organic coatings in such areas as reinforced concrete, pipelines, marine and automotive engineering. With its distinguished editor and international team of contributors, High-performance organic coatings is a valuable reference for all those concerned with preventing corrosion in steel and other metal structures. Reviews the factors affecting the success of a coating Describes the main types of coating and how their performance can be enhanced, including epoxies, polyester and waterborne coatings Examines applications in such areas as reinforced concrete pipelines and marine engineering

Chemistry and Technology of Thermosetting Polymers in Construction Applications Elsevier

Advances In Smart Coatings And Thin Films For Future Industrial and Biomedical Engineering Applications discusses in detail, the recent trends in designing, fabricating and manufacturing of smart coatings and thin films for future high-tech. industrial applications related to transportation, aerospace and biomedical engineering. Chapters cover fundamental aspects and diverse approaches used to fabricate smart self-healing anti-corrosion coatings, shape-memory coatings, polymeric and nano-bio-ceramic cotings, bio-inspired and stimuli-responsive coatings for smart surfaces with antibacterial activkity and controlled wettability, and electrically conductive coatings and their emerging applications. With the emphasis on advanced methodologies and recent emerging applications of smart multifunctional coatings and thin films, this book is essential reading for materials scientists and rsearchers working in chemical sciences, advanced materials, sensors, pharmaceutical and biomedical engineering. Discusses the most recent advances and innovations in smart multifunctional coatings and thin films in the transportation, aerospace and biomedical engineering industries Highlights the synthesis methods, processing, testing and characterization of smart coatings and thin films Reviews the current prospects and future trends within the industry

Szycher's Handbook of Polyurethanes, First Edition Vincentz Network GmbH & Co KG

This book addresses a broad spectrum of areas in both hybrid materials and hierarchical composites, including recent development of processing technologies, structural designs, modern computer simulation techniques, and the relationships between the processing-structure-property-performance. Each topic is introduced at length with numerous and detailed examples and over 150 illustrations. In addition, the authors present a method of categorizing these materials, so that representative examples of all material classes are discussed.

Hybrid and Hierarchical Composite Materials Elsevier

This completely revised edition remains the only comprehensive treatise on polymer coatings for electronics. Since the original edition, the applications of coatings for the environmental protection of electronic systems have greatly increased, largely driven by the competitive need to reduce costs, weight and volume. The demands for high-speed circuits for the rapid processing of signals and data, high-density circuits for the storage and retrieval of megabits of memory, and the improved reliability required of electronics for guiding and controlling weapons and space vehicles have triggered the development of many new and improved coating polymers and formulations. Both the theoretical aspects of coatings (molecular structure of polymer types and their correlation with electrical and physical properties) and applied aspects (functions, deposition processes, applications, testing) are covered in the book. Over 100 proprietary coating formulations were reviewed, their properties collated, and tables of comparative properties prepared. This book is useful as both a primer and as a handbook for collecting properties data.

Polymer/POSS Nanocomposites and Hybrid Materials Springer Science & Business Media

Pigmented organic/inorganic anticorrosive hybrid coatings were formulated by polysiloxane as the inorganic phase and polyurethane as the organic phase. The polyurethane provides excellent mechanical properties and barrier properties and the polysiloxane is severed as the corrosion inhibitor and adhesion promoter. This study concentrated on the effect of TEOS oligomers on pigmented organic/inorganic hybrid coatings. Tetraethyl orthosilicate (TEOS) oligomers were synthesized from TEOS monomer through the sol-gel process. Polyurethane was prepared from hexamethylene diisocyanate isocyanurates (abbreviated as 3HDI), alkoxysilane modified 3HDI and polyesters. Polyesters were prepared from 1,6-hexanediol (HD), isophthalic acid (IPA), 1,1,1-tris(hydroxymethyl)propane (TMP) and adipic acid (AA). The modified 3HDI were synthesized from (3-Aminopropyl) triethoxysilane (APTES) and 3HDI. TEOS oligomers, the polyesters, and modified 3HDI were characterized by FTIR, NMR, and MALDI-MS. Rutile TiO2 was added into coating systems as pigments. Several formulations of hybrid coatings were formulated with different concentration of TEOS oligomers and pigment volume concentration. Optical microscope was used to study the dispersion of TiO2. Electrochemical Impedance Spectroscopy was implemented to show the trend of corrosion resistance of different formulations. Furthermore, the corrosion resistance was furtherly studied by Salt Spray (ASTM B-117) and acid undercutting. Additionally, differential scanning calorimetry was utilized to investigate the variety of thermal property. The morphology of corrosion products was investigated using an optical microscope. Fracture toughness, elastic energy release rate, and tensile property were utilized to evaluate the mechanical property of cured coatings. Finally, adhesion performance, impact resistance, and hardness properties were also examined. It was surmised that the corrosion resistance obviously decreased with the high concentration of TEOS oligomers.

Advances and Developments in Polymer Nanocomposites John Wiley & Sons

Algae Based Polymers, Blends, and Composites: Chemistry, Biotechnology and Material Sciences offers considerable detail on the origin of algae, extraction of useful metabolites and major compounds from algal bio-mass, and the production and future prospects of sustainable polymers derived from algae, blends of algae, and algae based composites. Characterization methods and processing techniques for algae-based polymers and composites are discussed in detail, enabling researchers to apply the latest techniques to their own work. The conversion of bio-mass into high value chemicals, energy, and materials has ample financial and ecological importance, particularly in the era of declining petroleum reserves and global warming. Algae are an important source of biomass since they flourish rapidly and can be cultivated almost everywhere. At present the majority of naturally produced algal biomass is an unused resource and normally is left to decompose. Similarly, the use of this enormous underexploited biomass is mainly limited to food consumption and as bio-fertilizer. However, there is an opportunity here for materials scientists to explore its potential as a feedstock for the production of sustainable materials. Provides detailed information on the extraction of useful compounds from algal biomass Highlights the development of a range of polymers, blends, and composites Includes coverage of characterization and processing techniques, enabling research scientists and engineers to apply the information to their own research and development Discusses potential applications and future prospects of algae-based biopolymers, giving the latest insight into the future of these sustainable materials

Concepts, Methodologies, Tools, and Applications Springer

Encyclopedia of Renewable and Sustainable Materials provides a comprehensive overview, covering research and development on all aspects of renewable, recyclable and sustainable materials. The use of renewable and sustainable materials in building construction, the automotive sector, energy, textiles and others can create markets for agricultural products and additional revenue streams for farmers, as well as significantly reduce carbon dioxide (CO2) emissions, manufacturing energy requirements, manufacturing costs and waste. This book provides researchers, students and professionals in materials science and engineering with tactics and information as they face increasingly complex challenges around the development, selection and use of construction and manufacturing materials. Covers a broad range of topics not available elsewhere in one resource Arranged thematically for ease of navigation Discusses key features on processing, use, application and the environmental benefits of renewable and sustainable materials Contains a special focus on sustainability that will lead to the reduction of carbon emissions and enhance protection of the natural environment with regard to sustainable materials

Algae Based Polymers, Blends, and Composites Uv-curable Hybrid PolyurethanesThe organic/inorganic hybrid coatings have been intensively studied in recent years and it have been reported that the incorporation of inorganic components enhanced both the corrosion resistance and adhesion of organic coatings. The UV radiation has been widely used to cure coating resins for many years. The UV-curing process exhibits several distinguished advantages including rapid curing rate, low volatile organic compound (VOC) emission, high efficiency (energy, labor, and space), availability of curing heat sensitive substrates and so on. Given the advantages and distinguished features of hybrid coatings and UV-curing technique, a new type of UV-curable polyurethane/polysiloxane hybrid coating system was successfully developed in this study. The hybrid coating system was composed of three major components: organic phase, inorganic phase, and reactive diluents. The organic phase was based on acrylated urethane prepolymers which were prepared from isophorone diisocyanates (IPDI), 2-hydroxyethyl methacrylates (HEMA), and polyether polyols. The inorganic phase was based on tetraethyl orthosilicate (TEOS) oligomers which were prepared via sol-gel chemistry. UV-active reactive diluents were synthesized using IPDI, HEMA, and (3-aminopropyl) triethoxysilanes (APTES) to adjust the viscosity of coating formulations and afford compatibility between organic and inorganic phases as well. Fourier transform infrared spectroscopy (FTIR), 1H NMR spectroscopy and electrospray ionization-mas spectroscopy (ESI-MS) were used for the structural characterization of synthesized urethane prepolymers, reactive diluents, and TEOS oligomers. The UV-initiated photo-curing kinetics, viscoelastic properties, tensile properties, and general coating properties of the hybrid coatings were investigated. The results indicated that the photopolymerization process, viscoelastic properties, tensile and general properties were affected by the reactive diluents and

TEOS oligomers.Research Perspectives on Functional Micro- and Nanoscale Coatings
Silicon-Based Hybrid Nanoparticles: Fundamentals, Properties, and Applications focuses on the fundamental principles and promising applications of silicon-based hybrid nanoparticles in nanoelectronics, energy storage/conversion, catalysis, sensors, biomedicine, environment and imaging. This book is an important reference source for materials scientists and engineers who are seeking to understand more about the major properties and applications of silicon-based hybrid nanoparticles. As the hybridization of silicon nanoparticles with other semiconductors or metal oxides nanoparticles may exhibit superior features, when compared to lone, individual nanoparticles, this book provides the latest insights. In addition, the silicon/iron oxide hybrid nanoparticles also possess excellent fluorescence, super-paramagnetism, and biocompatibility that can be effectively used for the diagnostic imaging system in vivo. Similarly, gold-silicon nanohybrids could be used as highly efficient near-infrared hyperthermia agents for cancer cell destruction. Outlines the major thermal, electrical, optical, magnetic and toxic properties of silicon-based hybrid nanoparticles Describes major applications in energy, environmental science and catalysis Assesses the major challenges to manufacturing silicon-based nanostructured materials on an industrial scale
Handbook of Industrial Surfactants IGI Global
Uv-curable Hybrid Polyurethanes

Symposium Held ... John Wiley & Sons
Handbook of Polyurethanes serves as the first source of information of useful polymers. This new book thoroughly covers the entire spectrum of polyurethanes - from current technology to buyer's information. Discussions include: block and heteroblock systems rubber plasticity structure-property relations microphase separation catalysis of isocyanate reactions synthesis of polyurethanes for thermoplastics, thermosets, and curable compositions by either heat or U.V. energy biomedical applications of urethane elastomers castables, sealants, and caulking compounds flexible and semi-flexible foams health and safety This handbook compiles data from many sources, exhaustively illustrating the complex principles involved in polyurethane chemistry and technology. Handbook of Polyurethanes represents invaluable information for corporations, universities, or independent inventors.
Issues in Materials and Manufacturing Research: 2011 Edition Elsevier
The definitive guide to organic coatings, thoroughly revised and updated—now with coverage of a range of topics not covered in previous editions Organic Coatings: Science and Technology, Fourth Edition offers unparalleled coverageof organic coatings technology and its many applications. Written by three leading industry experts (including a new, internationally-recognized coatings scientist) it presents a systematic survey of the field, revises and updates the material from the previous edition, and features new or additional treatment of such topics as superhydrophobic, ice-phobic, antimicrobial, and self-healing coatings; sustainability, artist paints, and exterior architectural primers. making it even more relevant and useful for scientists and engineers in the field, as well as for students in coatings courses. The book incorporates up-to-date coverage of recent developments in the field with detailed discussions of the principles underlying the technology and their applications in the development, production, and uses of organic coatings. All chapters in this new edition have been updated to assure consistency and to enable extensive cross-referencing. The material presented is also applicable to the related areas of printing inks and adhesives, as well as areas within the plastics industry. This new edition Completely revises outdated chapters to ensure consistency and to enable extensive cross-referencing Correlates the empirical technology of coatings with the underlying science throughout Provides expert troubleshooting guidance for coatings scientists and technologists Features hundreds of illustrative figures and extensive references to the literature A new, internationally-recognized coatings scientist brings fresh perspective to the content. Providing a broad overview for beginners in the field of organic coatings and a handy reference for seasoned professionals, Organic Coatings: Science and Technology, Fourth Edition, gives you the information and answers you need, when you need them.