Aerogel Based Coating For Energy Efficient Building Envelopes

Winner of Choice Magazine - Outstanding Academic Titles for 2007 Buildings account for over one third of global energy use and associated greenhouse gas emissions worldwide. Reducing energy use by buildings is therefore an essential part of any strategy to reduce greenhouse gas emissions, and thereby lessen the likelihood of potentially catastrophic climate change. Bringing together a wealth of hard-to-obtain information on energy use and energy efficiency in buildings at a level which can be easily digested and applied, Danny Harvey offers a comprehensive, objective and critical sourcebook on low-energy buildings. Topics covered include: thermal envelopes, heating, cooling, heat pumps, HVAC systems, hot water, lighting, solar energy, appliances and office equipment, embodied energy, buildings as systems and community-integrated energy systems (cogeneration, district heating, and district cooling). The book includes exemplary buildings and techniques from North America, Europe and Asia, and combines a broad, holistic perspective with technical detail in an accessible and insightful manner.

Aerogels are the lightest solids known. Up to 1000 times lighter than glass and with a density as low as only four times that of air, they show very high thermal, electrical and acoustic insulation values and hold many entries in Guinness World Records. Originally based on silica, R&D efforts have extended this class of materials to non-silicate inorganic oxides, natural and synthetic organic polymers, carbon, metal and ceramic materials, etc. Composite systems involving polymer-crosslinked aerogels and interpenetrating hybrid networks have been developed and exhibit remarkable mechanical strength and flexibility. Even more exotic aerogels based on clays, chalcogenides, phosphides, quantum dots, and biopolymers such as chitosan are opening new applications for the construction, transportation, energy, defense and healthcare industries. Applications in electronics, chemistry, mechanics, engineering, energy production and storage, sensors, medicine, nanotechnology, military and aerospace, oil and gas recovery, thermal insulation and household uses are being developed with an estimated annual market growth rate of around 70% until 2015. The Aerogels Handbook summarizes state-of-the-art developments and processing of inorganic, organic, and composite aerogels, including the most important methods of synthesis, characterization as well as their typical applications and their possible market impact. Readers will find an exhaustive overview of all aerogel materials known today, their fabrication, upscaling aspects, physical and chemical properties, and most recent advances towards applications and commercial products, some of which are commercially available today. Key Features: •Edited and written by recognized worldwide leaders in the field •Appeals to a broad audience of materials scientists, chemists, and engineers in academic research and industrial R&D •Covers inorganic, organic, and composite aerogels •Describes military, aerospace, building industry, household, environmental, energy, and biomedical applications among others

This book focuses on aerogels and their applications in such areas as energy storage, thermal storage, catalysis, water splitting and environmental remediation. The materials covered include nanocellulose-, porous-, silica-, hybrid silica-, carbon-, graphene- and magnetic aerogels. Ways of modulating the pore structure of aerogels are presented, as well as surface modifications and the application of coatings. Future perspectives focus on functional foods, thickeners, stabilizers, and scaffolding in tissue repair. Keywords: Aerogels, Nanocellulose Aerogels, Non-Silicate Aerogels, Organic Aerogels, Composite Hybrid Aerogels, Carbon-based and Graphene-based Aerogels, Biogels, Hybrid Silica-based Aerogels, Energy Storage, Thermal Storage, Catalysis, Water Splitting, Environmental Remediation, Absorbents, Gas Filters, Packaging Materials, Electrical Devices, Thermal Insulations, Fire Retardants, Pharmaceutical and Biomedical Applications, Functional Foods, Thickeners, Stabilizers, Scaffolding in Tissue Repair.

Accompanyind CR-ROM conrtains The Encyclopedia of Materials Science and Technology on a web access disc.

This book explores the improvement in thermal insulation properties of protein-based silica aerogel composites fabricated by a novel, inexpensive and feasible method. The resulting material exhibits polymeric foam behavior including high compressibility, super-hydrophobic qualities and excellent strain recovery in addition to low thermal conductivity. The fabrication methodologies are explained in great detail and represented in flowcharts for easy reference and understanding. This monograph gives readers a new perspective on composite fabrication using methods other than the traditional ones and explores the endless ways of altering the composition to modify the properties of the silica aerogel composites. Applications for this novel composite are diverse and range from those in the pharmaceutical and aerospace industries to the oil and gas industries.

Thermoelectric materials are scrutinized as energy materials and sensing materials. Indeed, they convert thermal energy into electrical energy. In addition, those materials are actively sensitive to a temperature modification through the generation of an electric signal. Organic thermoelectric (OTE) materials are complementary to inorganic thermoelectric materials, as they possess unique properties such as solution processing, ionic conductivity, flexibility, and softness. While thin-film OTE materials have been widely studied because they are easily manufactured by various coating techniques, little is done in the creation of three-dimensional morphologies of OTE materials; which is important to develop large temperature gradients. Cellulose is the most abundant biopolymer on the planet. Recently, the applications of cellulose are not only limited in making papers but also in electronics as the cellulose provide 3-D microstructures and mechanical strength. One promising approach to make 3-D OTE bulks is using cellulose as scaffold because of their properties of relatively high mechanical strength, water processability and environmentally friendly performance. The aims of the thesis have been to enlarge the applications of an OTE material poly(3,4-ethylenedioxythiophene) (PEDOT), with an approach of making 3-D aerogels composite with nanofibrillated cellulose (NFC), in two main areas: (1) multi-parameter sensors and (2) solar vapor generators. In the first application, we demonstrate that the new thermoelectric aerogel responds

independently to pressure P, temperature T and humidity RH. Hence, when it is submitted to the three stresses (T, P, RH), the electrical characterization of the material enables to measure the three parameters without cross-talking effects. Thermoelectric aerogels are foreseen as active materials in electronic skins and robotics. In the second application, the conducting polymer aerogels are employed as solar absorbers to convert solar energy into heat and significantly increased the water evaporation rate. The IR absorption is efficient because of the free-electron in the conducting polymer PEDOT nano-aggregates. Because of the low cost of those materials and the water stability of the crosslinked aerogels, they could be of importance for water desalination. Termoelektriska material har utvärderats som energi- och sensormaterial. Som energimaterial har de studerats som ett sätt att transformera termisk energi till elektrisk energi, och har använts för kylnings- och uppvärmningsapplikationer. Som sensormaterial kan de känna av temperatur eller temperaturskillnader och tillhandahåller elektriska signaler. Organiska termoelektriska (OTE) material, det vill säga kolbaserade termoelektriska material, är komplementära till inorganiska termoelektriska material eftersom de har unika egenskaper så som processbarhet i lösningsform, jonisk ledningsförmåga, böjbarhet, och mjukhet. Tunna filmer av OTE-material har vida studerats eftersom de är lätta att tillverka via olika beläggningsmetoder, men tredimensionella strukturer är till stor del ett outforskat område och är viktigt för att uppnå stora temperaturgradienter. Cellulosa är ett billigt material som utgör den vanligaste biopolymeren på vår planet. Nyligen så har applikationerna för cellulosa sträckt sig bortom papperstillverkning och används nu även inom elektronik för att förse 3D-mikrostrukturer och mekanisk styrka. En lovande metod för att tillverka 3D-strukturer av OTE-material är genom att använda cellulosanätverk på grund av dess relativt höga mekaniska styrka, processbarhet i vattenlösningar och dess miljövänlighet. Syftet med denna avhandling har varit att bredda applikationerna för OTE-materialet poly(3,4-ethylenedioxythiophene) (PEDOT), genom att tillverka 3D aerogelkompositer med nanofibrillerad cellulosa (NFC). Detta har gjorts inom två områden: (1) Multiparameter-sensorer och (2) solar vapor generators. För den första applikationen så demonstrerar vi att de nya termoelektriska aerogelerna har oberoende signaler från tryck, temperatur och relativ fuktighet. Det vill säga att när materialet utsätts för dessa stimuli så kan signalerna som genereras urskiljas av utan överhörning. De termoelektriska aerogelena förutses bli användbara inom områden så som elektronisk hud och robotik. För den andra applikationen används de elektriskt ledande aerogelena för att absorbera solljus för att omvandla solenergi till värme vilket kan öka förångningshastigheten hos vatten. Absorptionen i IR-området är effektivt eftersom de rörliga elektronerna i den ledande polymeren nano-aggregerar. På grund av den låga kostnaden hos dessa material och våtstabiliteten hos korslänkade aerogeler kan dessa material tänkas användas för vattenavsaltning.

Saline land is a resource capable of significant production. Recent advances in research in breeding for salt tolerance in wheat, biotechnology in rice, and selection and rehabilitation of salt-tolerant plants are of economic importance in arid/saline conditions. This book gives some practical approaches for saline agriculture and afforestation, and describes examples of cultivating salt-tolerant/halophytic plants for commercial interest on salt-affected land or with highly salinized water in Australia, China, Central Asia, Egypt, Pakistan, and Russia. It also explores the possibilities of arid/saline agriculture and afforestation in UAE.

Provided are polymer-aerogel composite coatings, devices and articles including polymer-aerogel composite coatings, and methods for preparing the polymer-aerogel composite. The exemplary article can include a surface, wherein the surface includes at least one region and a polymer-aerogel composite coating disposed over the at least one region, wherein the polymer-aerogel composite coating has a water contact angle of at least about 140.degree. and a contact angle hysteresis of less than about 1.degree. The polymer-aerogel composite coating can include a polymer and an ultra high water content catalyzed polysilicate aerogel, the polysilicate aerogel including a three dimensional network of silica particles having surface functional groups derivatized with a silylating agent and a plurality of pores.

This volume contains the proceedings of the 11th KES International Conference on Sustainability and Energy in Buildings 2019 (SEB19) held in Budapest, 4th -5th July 2019 organised by KES International in partnership with Cardiff Metropolitan University, Wales, UK. SEB-19 invited contributions on a range of topics related to sustainable buildings and explored innovative themes regarding sustainable energy systems. The aim of the conference was to bring together researchers, and government and industry professionals to discuss the future of energy in buildings, neighbourhoods and cities from a theoretical, practical, implementation and simulation perspective. The conference formed an exciting chance to present, interact, and learn about the latest research and practical developments on the subject. The conference attracted submissions from around the world. Submissions for the Full-Paper Track were subjected to a blind peer-review process. Only the best of these were selected for presentation at the conference and publication in these proceedings. It is intended that this volume provides a useful and informative snapshot of recent research developments in the important and vibrant area of Sustainability in Energy and Buildings.

The papers included in this issue of ECS Transactions were originally presented in the symposium ¿Electrochemistry of Novel Electrode Materials for Energy Conversion and Storage¿, held during the 211th meeting of The Electrochemical Society, in Chicago, IL, from May 6 to 11, 2007.

Aerogels have been in use for over 80 years and have been utilised in a wide variety of applications, in particular, there has been growing use of insulating nanoporous materials in the aerospace industry. Recent awareness of the environmental implications of materials has driven researchers to develop new green materials, with aerogels being developed using biobased constituents, such as polysaccharides and proteins. Recently, biobased components, such as cellulose nanocrystals, have replaced synthetic counterparts in the production of nanoporous materials. Biobased Aerogelsis the first book to cover aerogel research from a green perspective, using commentary and analysis from leading researchers working in the field. Aerogels based on polysaccharides and proteins, their preparation and characterisation will be covered in detail, with further discussion highlighting properties such as surface morphology, shape recovery, mechanical properties and adsorption capacity. This insightful and timely publication will provide essential reading for those researchers and industrialists working within the green chemistry field.

Updated to reflect a growing focus on green chemistry in the scientific community and in compliance with the American Chemical Society's Committee on Professional Training guidelines, Carraher's Polymer Chemistry, Eighth Edition integrates the core areas that contribute to the growth of polymer science. It supplies the basic understanding of polymers essential to the training of science, biomedical, and engineering students. New in the Eighth Edition: Updating of analytical, physical, and special characterization techniques Increased emphasis on carbon nanotubes, tapes and glues, butyl rubber, polystyrene, polypropylene, polyethylene, poly(ethylene glycols), shear-thickening fluids, photo-chemistry and photophysics, dental materials, and aramids New sections on copolymers, including fluoroelastomers, nitrile rubbers, acrylonitrile-butadiene-styrene terpolymers, and EPDM rubber New units on spliceosomes, asphalt, and fly ash and aluminosilicates Larger focus on the molecular behavior of materials, including nano-scale behavior, nanotechnology, and nanomaterials Continuing to provide a user-friendly approach to the world of polymeric materials, the book allows students to integrate their chemical knowledge and establish a connection between fundamental and applied chemical information. It contains all of the elements of an introductory text with synthesis, property, application, and characterization. Special sections in each chapter contain definitions, learning objectives, questions, and additional reading, with case studies woven into the text fabric. Symbols, trade names, websites, and other useful ancillaries appear in the appendices to supplement the text.

U.S. households rely primarily on three sources of energy: natural gas, electricity, and fuel oil. In the past several decades, electricity consumption by households has grown dramatically, and a significant portion of electricity used in homes is for lighting. Lighting includes both indoor and outdoor lighting and is found in virtually every household in the United States. In 2001, according to the US Energy Information Administration, lighting accounted for 101 billion kWh (8.8 percent) of U.S. household electricity use. Incandescent lamps, which are commonly found in households, are highly inefficient sources of light because about 90 percent of the energy used is lost as heat. For that reason, lighting has been one focus area to increase the efficiency of household electricity consumption. Windows have several functions, and one of the main functions is to provide a view to the outside. Daylighting is another one of windows main functions and determines the distribution of daylight to a space. Daylighting windows do not need to be transparent, and a translucent daylighting window is sufficient, and often desired, to diffuse the light and make the space more environmentally pleasing. In homes, skylights are one source of daylighting, but skylights are not very energy efficient and are inseparably linked to solar heat gain. In some climates, added solar heat gains from daylighting may be welcome; but in other climates, heat gain must be controlled. More energy efficient skylights and daylighting solutions, in general, are desired and can be designed by insulating them with aerogels. Aerogels are a highly insulating and transparent material in its pure form. The overall objective for this project was to prepare an economical, translucent, fiber-reinforced aerogel insulation material for daylighting applications that is durable for manufacturing purposes. This advanced insulation material will increase the thermal performance of daylighting windows, while satisfying constraints such as durability, cost, user acceptance, size limits, and environmental safety concerns. The energy efficient daylighting window will consist of a translucent and resilient aerogel panel sandwiched between glass panes in double glazed windows. Compared to the best windows available today, the double glazed translucent windows with 1/2-inch aerogel inserts will have a U-value of 1.2 W/m2 K (0.211 BTU/ft2 h F) without any coating or low conductivity fill gases. These windows will be more effective than the windows with an Energy Star rating of U-2 W/m2 K and could be made even more efficient by using low-e coated glass glazings and inert gas fills. This report summarizes the work accomplished on Cooperative Agreement DE-FC26-03NT41950. During this project, Aspen Aerogels made transparent and translucent aerogels from TMOS and TEOS. We characterized the transparency of the aerogels, reinforced the transparent aerogels with fibers and prepared large translucent aerogel panels and blankets. We also conducted an initial market study for energy efficient translucent windows. A lab-scale process was developed that could be scaled-up to manufacture blankets of these translucent aerogels. The large blankets prepared were used to fabricate prototype translucent windows and skylights. The primary goal of this project was to develop transparent, resilient, hydrophobic silica aerogels that have low thermal conductivities (R-10/inch) to be used to produce aerogel insulated double-glazing windows with a U value of 0.6 W/m2K. To meet this objective we developed a process and equipment to produce blankets of translucent, hydrophobic aerogel. We focused on silica, organically-modified silica aerogels (Ormosils), and fiber reinforced silica aerogels due to the appreciable expertise in silica sol-gel processing available with the personnel at Aspen Aerogels, and also due to the quantity of knowledge available in the scientific literature. The project was conducted in three budget periods, herein called BP1, BP2 and BP3.

Environmental problems derived from the massive use of conventional energy resources are one of the main issues that our society has been facing in recent decades. Renewable energies (and particularly solar energy) have become a highly competitive means to meet the world's increasing energy demands in a sustainable and clean manner. One of the key research challenges for the commercial deployment of several solar energy technologies is focused on the development of feasible and durable coatings that withstand appropriate optical and thermal performance over the lifetime of the solar facilities. This book addresses a number of relevant aspects related to coatings for renewable energies, including a deep survey of coatings used in photovoltaic solar energy, the development of a superhydrophobic and thermal stable silica coating that is potentially suitable for various industrial applications related to renewable technologies, the development of coatings to improve the resistance of structural materials used in concentrating solar thermal technologies with molten salts, and several research works related to solar reflectors for concentrating solar thermal technologies (such us the advanced analysis of the corrosion, the suitability of anti-soiling coatings, and the development of top protective coatings for high-temperature secondary concentrators).

This book serves as a comprehensive resource on various traditional, advanced and futuristic material technologies for aerospace applications encompassing nearly 20 major areas. Each of the chapters addresses scientific principles behind processing and production, production details, equipment and facilities for industrial production, and finally aerospace application areas of these material technologies. The chapters are authored by pioneers of industrial aerospace material technologies. This book has a well-planned layout in 4 parts. The first part deals with primary metal and material processing, including nano manufacturing. The second part deals with materials characterization and testing methodologies and technologies. The third part addresses structural design. Finally, several advanced material technologies are covered in the fourth part. Some key advanced topics such as "Structural Design by ASIP", "Damage Mechanics-Based Life Prediction and Extension" and "Principles of Structural Health Monitoring" are dealt with at equal

length as the traditional aerospace materials technology topics. This book will be useful to students, researchers and professionals working in the domain of aerospace materials.
Concise Encyclopedia of Composite Materials draws its material from the award-winning Encyclopedia of Materials: Science and Technology, and includes updates and revisions not available in the original set. This customized collection of articles provides a handy reference for materials scientists and engineers with an interest in composite materials made from polymers, metals, ceramics, carbon, biocomposites, nanocomposites, wood, cement, fibers, etc. Brings together articles from the Encyclopedia of Materials: Science & Technology that focus on the essentials of composite materials, including recent updates Every article has been commissioned and written by an internationally recognized expert and provides a concise overview of a particular aspect of the field Enables rapid reference; extensive bibliographies, cross-referencing and indexes guide the user to the most relevant reading in the primary literature Covers areas of active research, such as biomaterials and porous materials
Sustainable Engineering for Life Tomorrow examines the future of sustainable engineering and architecture. The contributors' analyses of sustainable solutions, such as wind and solar power, offer valuable insights for future policy-making, scholarship, and the management of energy-intensive facilities.
The book focuses on aerogels for biomedical applications, thermal insulation, energy storage, fuel cells, batteries and environmental remediation. Keywords: Aerogels, Biomedical Applications, Implantable Devices, Tissue Engineering, Bone Regeneration, Biosensing, Pharmacological Applications, Catalysts, Water Purification, Pesticides, Thermal Insulation, Energy Storage, Fuel Cells, Batteries, Environmental Remediation, Polymer Aerogels, Bioaerogels, Carbon-based Aerogels.
This five-volume series provides a comprehensive overview of all important aspects of modern drying technology, concentrating on the transfer of cutting-edge research results to industrial use. Volume 3 discusses how desired properties of foods, biomaterials, active pharmaceutical ingredients, and fragile aerogels can be preserved during drying, and how spray drying and spray fluidized bed processes can be used for particle formation and formulation. Methods for monitoring product quality, such as process analytical technology, and modeling tools, such as Monte Carlo simulations, discrete particle modeling and neural networks, are presented with real examples from industry and academia.
This comprehensive three-volume handbook brings together a review of the current state together with the latest developments in sol-gel technology to put forward new ideas. The first volume, dedicated to synthesis and shaping, gives an in-depth overview of the wet-chemical processes that constitute the core of the sol-gel method and presents the various pathways for the successful synthesis of inorganic and hybrid organic-inorganic materials, bio- and bio-inspired materials, powders, particles and fibers as well as sol-gel derived thin films, coatings and surfaces. The second volume deals with the mechanical, optical, electrical and magnetic properties of sol-gel derived materials and the methods for their characterization such as diffraction methods and nuclear magnetic resonance, infrared and Raman spectroscopies. The third volume concentrates on the various applications in the fields of membrane science, catalysis, energy research, biomaterials science, biomedicine, photonics and electronics.
This book discusses various aspects of graphene fictionalization strategies from inorganic oxides and organic moieties including preparation, design, and characterization of functionalization material and its applications. Including illustrations and tables summarizing the latest research on manufacturing, design, characterization and applications of graphene functionalization, it describes graphene functionalization using different techniques and materials and highlights the latest technologies in the field of manufacturing and design. This book is a valuable reference resource for lecturers, students, researchers and industrialists working in the field of material science, especially polymer composites.
This book is the proceedings of the International Conference on Power Engineering-2007. The fields of this book include power engineering and relevant environmental issues. The recent technological advances in power engineering and related areas are introduced. This book is valuable for researchers, engineers and students majoring in power engineering.
Ceria-coated aerogels can include an aerogel support material having a stabilized ceria coating thereon. The ceria coating can be formed by solution or vapor deposition of alcogels or aerogels. Additional catalytic metal species can also be incorporated into the coating to form multi-metallic compounds having improved catalytic activity. Further, the ceria coated aerogels retain high surface areas at elevated temperatures. Thus, improvements in catalytic activity and thermal stability can be achieved using these ceria-coated composite aerogels.
This book results from a Special Issue published in Energies, entitled “Building Thermal Envelope". Its intent is to identify emerging research areas within the field of building thermal envelope solutions and contribute to the increased use of more energy-efficient solutions in new and refurbished buildings. Its contents are organized in the following sections: Building envelope materials and systems envisaging indoor comfort and energy efficiency; Building thermal and energy modelling and simulation; Lab test procedures and methods of field measurement to assess the performance of materials and building solutions; Smart materials and renewable energy in building envelope; Adaptive and intelligent building envelope; and Integrated building envelope technologies for high performance buildings and cities.
BioPolymers could be either natural polymers – polymer naturally occurring in Nature, such as cellulose or starch…, or biobased polymers that are artificially synthesized from natural resources. Since the late 1990s, the polymer industry has faced two serious problems: global warming and anticipation of limitation to the access to fossil resources. One solution consists in the use of sustainable resources instead of fossil-based resources. Hence, biomass feedstocks are a promising resource and biopolymers are one of the most dynamic polymer area. Additionally, biodegradability is a special functionality conferred to a material, bio-based or not. Very recently, facing the awareness of the volumes of plastic wastes, biodegradable polymers are gaining increasing attention from the market and industrial community. This special issue of Molecules deals with the current scientific and industrial challenges of Natural and Biobased Polymers, through the access of new biobased monomers, improved thermo-mechanical properties, and by substitution of harmful substances. This themed issue can be considered as collection of highlights within the field of Natural Polymers and Biobased Polymers which clearly demonstrate the increased interest in this field. We hope that this will inspire researchers to further develop this area and thus contribute to futures more sustainable society.”

This volume presents a comprehensive perspective on the global scientific, technological, and societal impact of nanotechnology since 2000, and explores the opportunities and research directions in the next decade to 2020. The vision for the future of nanotechnology presented here draws on scientific insights from U.S. experts in the field, examinations of lessons learned, and international perspectives shared by participants from 35 countries in a series of high-level workshops organized by Mike Roco of the National Science Foundation (NSF), along with a team of American co-hosts that includes Chad Mirkin, Mark Hersam, Evelyn Hu, and several other eminent U.S. scientists. The study performed in support of the U.S. National Nanotechnology Initiative (NNI) aims to redefine the R&D goals for nanoscale science and engineering integration and to establish nanotechnology as a general-purpose technology in the next decade. It intends to provide decision makers in academia, industry, and government with a nanotechnology community perspective of productive and responsible paths forward for nanotechnology R&D.

Novel breakthroughs in the cutting-edge field of nanotechnology, as a cross-sectional technology, show potential for being applied across the whole value chain of the energy sector (energy sources, energy conversion, energy distribution, energy storage, and energy use). This book gives an overview of nanotechnological applications within the value chain of the energy sector and evaluates selected applications and their direct and indirect impacts on the energy sector. It presents selected nanotechnological applications that influence the energy economy significantly. Furthermore, the authors give a comprehensive description of the impacts and outcomes of selected nanotechnological applications on energy consumption, energy sources, energy supply, and the energy industry in Germany and show the potential of these applications for energy savings, improvement in energy efficiency, and the reduction of emissions until 2030.

Popular Science gives our readers the information and tools to improve their technology and their world. The core belief that Popular Science and our readers share: The future is going to be better, and science and technology are the driving forces that will help make it better.

A comprehensive overview and summary of recent achievements and the latest trends in bioinspired thermal materials. Following an introduction to different thermal materials and their effective heat transfer to other materials, the text discusses heat detection materials that are inspired by biological systems, such as fire beetles and butterflies. There then follow descriptions of materials with thermal management functionality, including those for evaporation and condensation, heat transfer and thermal insulation materials, as modeled on snake skins, polar bears and fire-resistant trees. A discussion of thermoresponsive materials with thermally switchable surfaces and controllable nanochannels as well as those with high thermal conductivity and piezoelectric sensors is rounded off by a look toward future trends in the bioinspired engineering of thermal materials. Straightforward and well structured, this is an essential reference for newcomers as well as experienced researchers in this exciting field.

This book discusses novel nanomaterials and their various aspects. Chapters provide detailed information on new preparation routes for novel nanomaterials and their applications in supercapacitors, nanogenerators, removal of industrial pollutants, biosensors, self-cleaning coatings, aquatic robotics, and the construction industry.

This book shares the latest developments and advances in materials and processes involved in the energy generation, transmission, distribution and storage. Chapters are written by researchers in the energy and materials field. Topics include, but are not limited to, energy from biomass, bio-gas and bio-fuels; solar, wind, geothermal, hydro power, wave energy; energy-transmission, distribution and storage; energy-efficient lighting buildings; energy sustainability; hydrogen and fuel cells; energy policy for new and renewable energy technologies and education for sustainable energy development.

An up-to-date and comprehensive overview summarizing recent achievements, the state of the art, and trends in research into nanocellulose and cellulose nanocomposites. Following an introduction, this ready references discusses the characterization as well surface modification of cellulose nanocomposites before going into details of the manufacturing and the self-assembly of such compounds. After a description of various alternatives, including thermoplastic, thermosetting, rubber, and fully green cellulose nanocomposites, the book continues with their mechanic and thermal properties, as well as crystallization and rheology behavior. A summary of spectroscopic and water sorption properties precedes a look at environmental health and safety of these nanocomposites. With its coverage of a wide variety of materials, important characterization tools and resulting applications, this is an essential reference for beginners as well as experienced researchers.

This book presents the current state of knowledge on nanomaterials and their use in buildings, ranging from glazing and vacuum insulation to PCM composites. It also discusses recent applications in organic photovoltaics, photo-bioreactors, bioplastics and foams, making it an exciting read while also providing copious references to current research and applications for those wanting to pursue possible future research directions. Derek Clements-Croome, Emeritus Professor in Architectural Engineering, University of Reading (From the Foreword) Demonstrating how higher energy efficiency in new and existing buildings can help reduce global greenhouse gas emissions, this book details the way in which new technologies, manufacturing processes and products can serve to abate emissions from the energy sector and offer a cost-effective means of improving competitiveness and drive employment. Maximizing reader insights into how nano and biotech materials – such as aerogel based plasters, thermochromic glazings and thermal energy adsorbing glass, amongst others – can provide high energy efficiency performance in buildings, it provides practitioners in the field with an important high-tech tool to tackle key challenges and is essential reading for civil engineers, architects, materials scientists and researchers in the area of the sustainability of the built environment.

Advancements in polymer nanocomposite foams have led to their application in a variety of fields, such as automotive, packaging, and insulation. Employing nanocomposites in foam formation enhances their property profiles, enabling a broader range of uses, from conventional to advanced applications. Since many factors affect the generation of nanost