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A central resource of technology and methods for environments where the control of contamination is critical. The technical developments in the sports clothing industry has resulted in the use of functional textiles for highly-specialised performances in different sports. Developments include thermal and functional properties and coated and laminated clothes. With bio- and smart materials providing such a strong focus in the textile industry generally, companies are going for 'value-added' textiles, such as in-built sensors which monitor performance. In-built wear comfort is a growing market trend and includes clothing which improves the skin's performance. Written by a distinguished editor and a team of authors from the cutting edge of textile research, Textiles in sport discusses high-performance, high-function and intelligent textiles for sportswear. Invaluable for a broad range of readers Discusses high-performance, high-function and intelligent textiles for sportswear

Few are more vulnerable to infectious disease exposure than laboratory staff. On a daily basis, laboratorians handle samples, specimens, and substances that, if handled improperly, could infect both staff and patients. Does your lab have a plan in place to handle an infectious disease event? Introducing the first fully comprehensive resource on infection control (IC) written exclusively for labs, Laboratory Infection Control: Essential Procedures for Compliance. This all-in-one IC compliance guide covers all the critical regulatory information lab staff need to know when crafting and following an effective infection control program. As labs face new threats of emerging communicable diseases, infection control has come to the forefront of lab safety. The 2006 Joint Commission laboratory accreditation standards dictate that labs must prepare to respond to an influx of infectious patients. Now, more than ever, it is vital that your lab have a plan in place to prevent the introduction of healthcare-associated infections recognize when patients and staff have become infected contain the risk or spread of infection safely Laboratory Infection Control makes these critical action points easier than ever to implement in your facility. Finally, a resource to meet YOUR needs! Laboratory Infection Control is the only resource available that provides the essential tips, tools, and instructions for creating or redesigning a successful IC plan for labs. In just 150 easy-to-read pages, you'll learn how to assess the risks of transmission of communicable diseases within the lab and create a safe work environment. This user-friendly guide includes all the latest regulations and guidelines from OSHA to the CDC, and offers 1-2-3 strategies for establishing best practice in employee health and safety isolation precautions aseptic techniques engineering controls infectious-waste management hand hygiene biosafety levels and more! P

Human sensory perception of clothing involves a series of complex interactive processes, including physical responses to

external stimuli, neurophysiological processes for decoding stimuli through the biosensory and nervous systems inside the body, neural responses to psychological sensations, and psychological processes for formulating preferences and making adaptive feedback reactions. Clothing biosensory engineering is a systematic and integrative way of translating consumers' biological and sensory responses, and psychological feelings and preferences about clothing, into the perceptual elements of design. It is a link between scientific experimentation and commercial application to develop economic solutions to practical technical problems. Clothing biosensory engineering quantifies the decision-making processes through which physics, mathematics, neurophysiological and engineering techniques are applied to optimally convert resources to meet various sensory requirements – visual/thermal/mechanical. It includes theoretical and experimental observations, computer simulations, test methods, illustrations and examples of actual product development. Describes the process of Clothing biosensory engineering in detail Quantifies the decision making processes applied to optimally convert resources to meet various sensory requirements Includes theoretical and experimental observations and examples of actual product development

This book highlights the environmental and economic benefits of recycling in textiles and fashion; vis-a-vis virgin textiles. Recycling plays an inevitable part when it comes to sustainable innovations in textiles and fashion sector. As basic information pertaining to the benefits, challenges of recycling in textiles are discussed to the sufficient extent in the literature, this book deals with the innovative at the same time, sustainable products made from the recycled textiles. The intimate apparel business is undergoing major technological change. New measurement and design techniques, combined with innovative materials and production methods, are transforming the range, quality and applications of women's lingerie. This important book provides an authoritative review of these developments After an introductory chapter on the concept of body beauty, a first group of chapters discuss innovations in the manufacture of brassieres, including developments in breast measurement and sizing, innovations in bra design and improvements in bra pattern technology. The following sequence of chapters reviews key developments in girdles. Topics discussed include innovations in girdle design and use and research on the physiological effects of body shapers. The book concludes by assessing developments in intimate apparel with special functions such as sports bras, and innovation in knitted and seamless intimate apparel. Innovation and technology of women's intimate apparel is a standard reference for designers and engineers working in this important area of the textile industry. Reviews the technological and innovative developments of ladies intimate apparel Describes the research principles and scientific understandings of size, materials, pattern and fit to achieve functional and technical design Written by leading experts in the field

Natural Fiber Textile Composite Engineering sheds light on the area of the natural fiber textile composites with new

research on their applications, the material used, the methods of preparation, the different types of polymers, the selection of raw materials, the elements of design the natural fiber textile polymer composites for a particular end use, their manufacturing techniques, and finally their life cycle assessments (LCA). The volume also addresses the important issue in the materials science of how to utilize natural fibers as an enhancement to composite materials. Natural fiber-reinforced polymer composites have been proven to provide a combination of superior mechanical property, dielectric property, and environmental advantages such as renewability and biodegradability. Natural fibers, some from agricultural waste products, can replace existing metallic and plastic parts and help to alleviate the environmental problem of increasing amounts of agriculture residual. The book is divided into four sections, covering: applications of natural fiber polymer composites design of natural fiber polymer composites composite manufacturing techniques and agriculture waste manufacturing composite material testing methods The first section of the book deals with the application of textile composites in the industry and the properties of the natural fibers, providing an understanding of the history of natural fiber composites as well as an analysis of the different properties of different natural fibers. The second section goes on to explain the textile composites, their classification, different composite manufacturing techniques, and the different pretreatment methods for the natural fibers to be used in composite formation. It also analyzes the composite material design under different types of loading and the mechanism of failure of the natural fiber composite. The effect of the fiber volume fraction of different textile structures is explained. The third section of the book, on composite manufacturing techniques and agriculture waste manufacturing, concerns the natural fiber composite manufacturing techniques, agricultural waste, and the methods of their preparation to be used successfully in the composite, either in the form of fibers particles or nanoparticles. The book then considers the testing methods of the different composite components as well as the final composite materials, giving the principle of the testing standards, either destructive or nondestructive. This book attempts to fill the gap between the role of the textile engineer and the role of the designer of composites from natural fibers. It provides important information on the application of textile composites for textile engineers, materials engineers, and researchers in the area of composite materials.

This book comprises the select proceedings of the International Conference on Emerging Trends in Traditional and Technical Textiles (ICETT 2019), and examines the latest developments and automation in the field of textile technology. The topics covered include geotextiles, filters, medical textiles, functional finishing of textiles, composites, sustainable textile materials, and pollution in the textile industry. The book also discusses various aspects of traditional textiles including traditional methods of designing textiles, traditional textiles as a new avatar for technical textiles, traditional and technical assets of Indian and Asian culture: phulkari, bagh, kalamkari and chope embroideries. This book can be useful for students, researchers, and professionals working in traditional textile design and technical textile applications.

Using an easy-to-use checklist format, author Jeffrey Stull, an internationally recognized expert in the area of protective clothing, examines

the types of industrial and fire hazards that warrant PPE protection. He also covers how to select equipment from the range of products available, which materials are affected by the hazards, and how that influences selection, care, and maintenance of PPE.

Understanding and improving hygiene and healthcare products is essential for improving infection prevention. Continuing Woodhead Publishing's series of specialised medical textile books, *Textiles for hygiene and infection control* provides readers with the latest developments in healthcare materials for hygiene and infection applications. Part one offers an insight into design and production techniques for hygiene textiles. Chapters discuss nanotechnology and its applications in hygiene textiles, knitted spacer fabrics, innovative and sustainable packaging and biodegradable hygiene products. Part two explores design and production techniques for infection control textiles. Chapters examine micro-organisms, infection and the role of textiles, the creation of barrier textiles through plasma processing and methods for ensuring fabrics survive sterilisation. Part three concludes by investigating the variety of available hygiene and infection control products. Chapters consider washable textile-based absorbent products for incontinence, coated textiles for skin infections and antimicrobial treatments of textiles for hygiene and infection control applications from an industrial perspective. *Textiles for hygiene and infection control* is an essential reference for manufacturers, designers, engineers and producers of hygiene and infection control products. It is also a useful tool for medical scientists, surgeons and nurses. Offers insight into design and production techniques for hygiene textiles Chapters discuss a range of applications, such as the use of textiles for incontinence An essential reference for manufacturers, designers, engineers and producers of hygiene and infection control products

Coating and lamination offer methods of improving and modifying the physical properties and appearance of fabrics and also the development of entirely new products by combining the benefits of fabrics, polymers and films. This detailed book covers all aspects of coating and lamination within the textile industry including – compound ingredients, how to set and adhere to strictly controlled processing conditions, the accurate control of production variables, the safe handling of toxic materials and the ongoing research into future products which will facilitate recycling and disposal. This book is particularly useful in the insight it gives about the challenges and opportunities that these new treatments offer and is essential reading for technologists, chemists and production engineers working in this exciting field.

Authoritative review of the latest developments in coating and lamination processes for textiles Focuses on the importance of setting and adhering to processing conditions Written by the author of the well-known *Textiles in automotive engineering*

Advanced Textiles for Wound Care, Second Edition, provides a detailed review of how textiles are incorporated into wound care applications, also explaining the importance and suitability of using textiles on different wound types. It is an interdisciplinary book which directly links textile technology with advances in wound care. The book discusses new developments and techniques related to antimicrobial dressings, the use of biopolymers in infection control management, advanced dressings for managing cavity and cancerous wounds, and the application of nanofibers and novel textile structures in scaffolds, among other new areas. This updated edition also reflects recent changes in regulatory affairs. The book is essential reading for manufacturers, designers, scientists and producers of wound care materials. It is a valuable resource for professionals within the medical sector, as well as those in academia, enabling materials scientists and engineers in both academia, and at medical device companies, to stay abreast of new technology. Provides a comprehensive introduction to wound care, from the different types of wound and wound healing mechanisms, to the importance of testing in relation to wound care Analyzes the application of textiles to wound healing, covering minor wounds, burns, ulcers and other deep skin wounds Reviews the current use of smart textiles for wound care, including drug delivery dressings and textile-based scaffolds for tissue engineering

Smart Textiles: Wearable Nanotechnology provides a comprehensive presentation of recent advancements in the area of smart nanotextiles giving specific importance to materials and production processes. Different materials, production routes, performance characteristics, application areas and functionalization mechanisms are covered. The book provides a guideline to students, researchers, academicians and technologists who seek novel solutions in the related area by including groundbreaking advancements in different aspects of the diverse smart nanotextiles fields. This ground-breaking book is expected to spark an inspiration to allow future progress in smart nanotextiles research. The diversity of the topics, as well as the expert subject-matter contributors from all over the world representing various disciplines, ensure comprehensiveness and a broad understanding of smart nanotextiles.

Nonwovens are a unique class of textile material formed from fibres that are bonded together through various means to form a coherent structure. Given their rapid industrial development and diverse markets, understanding and developing nonwovens is becoming increasingly important. With its distinguished editor and array of international contributors, the Handbook of nonwovens, offers a comprehensive review of the latest advances in this area and how they can be applied to particular products. Initial chapters review the development of the industry and the different classes of nonwoven material. The book then discusses methods of manufacture such as dry-laid, wet-laid and polymer-laid web formation. Other techniques analysed include mechanical, thermal and chemical bonding as well as chemical and mechanical finishing systems. The book concludes by assessing the characterisation, testing and modelling of nonwoven materials. Handbook of nonwovens is a valuable reference for those involved in the manufacturing and use of nonwoven products in such areas as; transport, medicine, hygiene and various branches of engineering. Provides a comprehensive review of the latest advances in this important area Written by leading experts in the field Discusses different methods of manufacture, bonding and finishing

Plasma technologies present an environmentally-friendly and versatile way of treating textile materials in order to enhance a variety of properties such as wettability, liquid repellency, dyeability and coating adhesion. Recent advances made in commercially viable plasma systems have greatly increased the potential of using plasma technology in industrial textile finishing. This pioneering book provides an essential guide to both the technology and science related to plasmas and its practical applications in the textile industry. The first part of the book discusses the science and technology behind plasmas. Chapters give detailed and comprehensive descriptions on the characteristics of plasmas and methods of control and treatment in the processing of textiles. Both low pressure cold plasma and atmospheric pressure cold plasma processes are described as well as the diagnosis and control of plasma parameters in plasma generating reactors. A chapter is devoted to the use of plasma technology to achieve nanoscale treatment of textile surfaces. The second part of the book concentrates on specific applications of plasma technologies. Chapters cover treatments for water and oil repellency of textiles, engineering of biomedical textiles and woollen finishing techniques through the use of plasma technologies. Further chapters cover the modification of fibres for use in composites and the potential use of plasma technologies for the finishing of fabrics made of man made fibres. The final chapter in the book gives a comprehensive analysis of the surface chemical and physical characterisation of plasma treated fabrics. Written by a distinguished international team of experts, Plasma technologies for textiles is an invaluable reference for researchers, scientists and technologists alike. Summarises both the science and technology of plasma processing, and its practical applications Discusses

how plasma technology improves textile properties such as wettability and liquid repelling An invaluable reference for researchers, scientists and technologists

Welcome to the 3rd Indonesian Textile Conference (ITC) 2019. It is our great honor and pleasure to have you all here today. Indonesian Textile Conference is by far the only scientific event in the field of textiles in Indonesia aimed to bring together leading researchers, experts, students and people from the industry to share their knowledge and exchange scientific ideas. Indonesia is one of the leading textile exporter countries in the world with a total export value of USD 15.3 billion in 2015 and ranked the third after palm oil and steel (source: Ministry of Industry of Republic of Indonesia). It is one of the ten priority industries and the mainstay of Indonesian national industry. In a global economy and fast changing world, the future of Indonesian textile industry will increasingly depend on the industry's ability to relentlessly innovate in its products, to use the most advanced, flexible and resource-efficient processes and to focus its organizational structure as well as business operations according to the ever changing and growing needs of its customers. In all that, research and innovation are vital and play an ever increasing role. Indonesian Textile Conference was initiated and is dedicated to promote and bring progress to research and innovation in the field of textile and textile-related subjects in Indonesia. Textile is a rich multidisciplinary area of study and in fact has attracted a great deal of attention and numerous contributions from non-textile scientists. It is not just about clothing. It is all about material and all aspects that are inherent in the process of its production and applications. It covers a whole lot of area which includes but not limited to: advanced material and textile fibers, natural fibers and natural dyes, utilization of natural sources for textiles in general and/or functional textiles, environmental protection and ecological considerations in textile industry, life cycle analysis, clean/green production, best practices in energy efficient processes, bio-based polymer, bioengineering, nanotechnology, textile-based composites, industrial management and engineering, traditional textiles and batik, textile preservation and conservation, and design. Smart, functional and interactive textile is another area of interest which is quite recent and resulted from the convergence of latest developments in material science, physics and chemistry, microelectronics and informatics. Stimuli responsive materials, self-healing polymers, textile energy devices, textile sensor and antenna are only a few examples of development in this area. Recently added to this is a new emerging "fashionable technology". It is a new concept that brings fashion to the next level by integrating technology and fashion. It looks at the future fashion as intersection of design, fashion, science, and technology beyond wearable technology. Still another important and interesting issue in textile is sustainability, especially due to the stigma associated with the industry as the big polluter and being not environmentally-friendly. Sustainable textiles and clothing involves the choice of materials, technologies and processing methods that ensure environmental and social friendliness and safety to human health throughout the entire life-cycle phases. Thus, there is an ample room for almost everyone to contribute in this conference. On behalf of the Organizing Committee and the management of Politeknik STTT Bandung, have a productive and fruitful conference.

The present book volume presents a holistic view of the aspects of nanobiomaterials incl. their stellar merits and limitations,

applications in diverse fields, their futuristic promise in the fields of biomedical science and drug delivery. The federal & regulatory issues on the usage of nanobiomaterials have been assigned due consideration.

Latest Material and Technological Developments for Activewear provides comprehensive coverage of academic research and industrial advances in this fast-moving field. As society becomes more health conscious, athleisure and sportswear have arrived as key fashion items in the global apparel market. In this book, designers and material scientists will find information on fibers and textiles, new processes, emerging technologies, and new applications that have helped to deliver this new wave of products. In addition to these technical details, the book covers consumer behavior, along with product design and manufacturing.

Advanced Knitting Technology provides complete coverage of the latest innovations and developments in knitting technology, including emerging methods as well as the latest best practice for classical processes. Many technologies can be used for the production of cloth such as weaving, knitting, nonwoven, and braiding. Knitting methods are being selected for a growing range of applications due to the spectacular properties of knitted fabric, such as softer tactile quality, higher stretchability, bulkiness, and functional properties that compare favorably with other woven fabrics. Beyond the well-known apparel applications, specially designed knitted structures are uniquely suitable for high performance applications like reinforcement for composites, medical implants, and geotextiles. This book presents recent advances in knitting technology, including structures, properties and applications of knitted fabrics in modern apparel, activewear, composites, medical textiles, and geotextiles. With reference to the latest industry practice, testing, quality and process control methods for knitting technologies are discussed. Advanced Knitting Technology covers recent advances in knitting technology, properties and performance of knitted structures, their applications in apparel and technical fields. Provides detailed and practical instructions for the sustainable production of knitted textiles, including sustainable chemical processing natural dyeing processes, and sustainability analysis methods Draws on the latest research to discuss the future of knitted apparels and high-tech applications of knitted structures as technical textiles Explores the latest applications of AI and machine learning to the knitting process

This volume contains select papers presented during the Functional Textiles and Clothing Conference 2020 held at Indian Institute of Technology Delhi. The volume covers recent developments, challenges and opportunities in the field of functional and protective clothing; functional printing and finishing; sustainable production and supply chain; and testing and characterisation. This volume will be of interest to researchers, professional engineers, entrepreneurs, and market stakeholders interested in functional textiles and clothing.

Synthetic Polymeric Membranes for Advanced Water Treatment, Gas Separation, and Energy Sustainability is a cutting-edge guide that focuses on advanced water treatment applications, covering oily wastewater treatment, desalination, removal of dyes and pigments, photodegradation of organic hazardous materials, heavy metal removal, removal and recovery of nutrients, and volatile organic compounds. Other sections examine the area of gas separation, including acidic gas removal, oxygen enrichment, gas and vapor separation, hydrogen separation, and gas sensing. Final sections cover applications for sustainable energy usage,

including the use of synthetic polymer membranes in proton exchange membrane fuel cells (PEMFCs), and more. This is a highly valuable guide for researchers, scientists, and advanced students, working with polymer membranes and films, and across polymer science, polymer chemistry, materials science, chemical e Explains the design, preparation and characterization of synthetic polymer-based membranes for advanced applications Provides a clear picture of the state-of-the-art in the field, including novel fabrication approaches and the latest advances in physico-chemical characterizations Supports the development and implementation of innovative, sustainable solutions to water treatment, gas separation and energy devices

Sewn Product Quality: A Management Perspective takes complex industry-specific terminology and processes and explains them with pictures and text that is relevant to today's market. The book discusses all aspects of quality, devoting separate sections to materials and processes and focusing specifically on the new consumer-centric business environment. Taking a managerial perspective, it presents definitions, techniques, and standards unique to the sewn products industry and shows how to impact quality throughout the design, production and delivery process.

An authentic resource for the fundamentals, applied techniques, applications and recent advancements of all the main areas of technical textiles Created to be a comprehensive reference, **High Performance Technical Textiles** includes the review of a wide range of technical textiles from household to space textiles. The contributors—noted experts in the field from all the continents—offer in-depth coverage on the fibre materials, manufacturing processes and techniques, applications, current developments, sustainability and future trends. The contributors include discussions on synthetic versus natural fibres, various textile manufacturing techniques, textile composites and finishing approaches that are involved in the manufacturing of textiles for a specific high performance application. Whilst the book provides the basic knowledge required for an understanding of technical textiles, it can serve as a springboard for inspiring new inventions in hi-tech fibres and textiles. This important book: Contains a unique approach that offers a comprehensive understanding of the manufacturing and applications of technical textiles Includes a general overview to the fundamentals, current techniques, end use applications as well as the most recent advancements Explores the current standards in the industry and the ongoing research in the field Offers a comprehensive and single source reference on the topic Written for academics, researchers and professionals working in textile and related industries, **High Performance Technical Textiles** offers a systematic, structured, logical and updated source of information for understanding technical textiles.

Innovation and Technology of Women's Intimate Apparel Woodhead Publishing

This book presents a comprehensive treatment of both functional and decorative textiles used in the automotive industry including seat covers, headliners, airbags, seat belts and tyres. Written in a clear, concise style it explains material properties and the way in which they influence manufacturing processes as well as providing practical production details. The subject treatment cuts across the disciplines of textile chemistry, fabric and plastics technology and production engineering. Environmental effects and recycling are also covered. It is aimed at the design and process engineer in industry as well as researchers in universities and colleges. Quality engineers will also benefit from the book's sections on identifying problems and material limitations.

Optimization and decision making are integral parts of any manufacturing process and management system. The objective of this book is to demonstrate the confluence of theory and applications of various types of multi-criteria decision making and optimization techniques with reference to textile manufacturing and management. Divided into twelve chapters, it discusses various multi-criteria decision-making methods

such as AHP, TOPSIS, ELECTRE, and optimization techniques like linear programming, fuzzy linear programming, quadratic programming, in textile domain. Multi-objective optimization problems have been dealt with two approaches, namely desirability function and evolutionary algorithm. Key Features Exclusive title covering textiles and soft computing fields including optimization and decision making Discusses concepts of traditional and non-traditional optimization methods with textile examples Explores pertinent single-objective and multi-objective optimizations Provides MATLAB coding in the Appendix to solve various types of multi-criteria decision making and optimization problems Includes examples and case studies related to textile engineering and management

Active Coatings for Smart Textiles presents the latest information on active materials and their application to textiles in the form of coatings and finishes for the purpose of improving performance and creating active functional effects. This important book provides detailed coverage of smart coating types, processes, and applications. After an introduction to the topic, Part One introduces various types of smart and active coatings, including memory polymer coatings, durable and self-cleaning coatings, and breathable coatings. Technologies and related processes for the application of coatings to textiles is the focus of Part Two, with chapters devoted to microencapsulation technology, plasma surface treatments, and nanotechnology-based treatments. The book ends with a section on applications of smart textiles with responsive coatings, which are increasingly finding commercial niches in sportswear, protective clothing, medical textiles, and architecture. Introduces various types of smart and active coatings for textiles Covers technologies and application processes for the coating and finishing of textiles Reviews commercial applications of such coatings, including in sportswear, protective clothing, medical textiles and architecture

As consumer demands for specific attributes in their textiles increase and global competition intensifies, it is important that the industry finds ways of engineering certain performance requirements into textiles and apparel. This book reviews how fabrics and garments can be engineered to meet technical performance and other characteristics required for the specific end-use. Chapters begin with fabric and garment handle and making – up performance, followed by wear appearance issues, such as wrinkling, pilling and bagging. Further chapters include fabric and garment drape, durability related issues, as well as physiological and psychological comfort. Key topics of fire retardancy, waterproofing, breathability and ultraviolet protection are also discussed. Written by two highly distinguished authors, this is an invaluable book for a wide range of readers in the textile and apparel industries, ranging from textile and garment manufacturers, designers, researchers, developers to buyers. Reviews the engineering of fabrics to meet technical performance requirements for specific end-use Chapters examine various wear appearance issues such as wrinkling, bagging and fabric and garment drape Discusses durability related issues including fire retardancy and waterproofing as well as psychological and physiological fabric comfort

This book provides a broad understanding of the main computational techniques used for water hammer research in water systems. The theoretical background to a number of techniques is introduced, and general data analysis techniques and examining the application of techniques in an industrial setting, including current practices and current research, are considered. The book also provides practical experience of commercially available systems and includes small-scale water systems related projects.

This major textbook is designed for students studying textiles and fashion at higher and undergraduate level, as well as those needing a comprehensive and authoritative overview of textile materials and processes. The first part of the book reviews the main types of natural and synthetic fibres and their properties. Part two provides a systematic review of the key processes involved first in converting fibres into yarns and then transforming yarns into fabrics. Part three discusses the range of finishing techniques for fabrics. The final part of the book looks specifically at the transformation of fabric into apparel, from design and manufacture to marketing. With contributions from leading

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experts in their fields, this major book provides the definitive one-volume guide to textile manufacture. Provides comprehensive coverage of the types and properties of textile fibres to yarn and fabric manufacture, fabric finishing, apparel production and fashion Focused on the needs of college and undergraduate students studying textiles or fashion courses Each chapter ends with a summary to emphasise key points, a comprehensive self-review section, and project ideas are also provided

This book reviews the manufacturing processes of different shopping bags used for grocery purposes, life cycle impacts, modelling of life cycle impacts, carbon and eco-footprints in different countries, consumption of shopping bags in different countries, consumer behaviour of shopping bags in various countries and its relation to eco-impact, assessment of functionality of shopping bags, concept and framework of eco-functional assessment of shopping bags, biodegradation of shopping bags, etc.

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