

Wood modification

Chemical processes

Active modification

- Acetylation (Accoya™)
- Resin impregnation
 - Compreg™
 - PF-resin
 - Other type of chemicals
- Furfurylation
 - Kebony™
 - Other types, e.g. Keywood™, Nobelwood™
- DMDHEU
 - Belmadur™, Hartholz™
- Silicate/silane-based

Passive modification

- Resin impregnation (Impreg™)
 - Melamine resin
 - Other chemicals e.g. methacrylate
- Chitosan
- Natural oils/waxes/paraffins
- Polyethylene glycol
- Indurite™, Lignia™

Thermally-based processes

Thermo treatment

- Charring of wood surfaces

Thermo-hydro treatment

- Releasing internal stresses
- Softening
- Drying
- Ageing
- Thermal modification

Thermo-mechanical treatment

- Self-bonding of veneer
- Frictional wood welding

Thermo-hydro-mechanical treatment

- Bending
 - solid wood
 - laminated wood
- Moulding
 - surface
 - cross-sectional
- Bulk densification
- Surface densification

EPL processes*

Electromagnetic treatment

- Ultraviolet light (UV)
- Infrared light (IR)
- Microwave (MW)
- High-frequency (HF)

Plasma treatment

- Cold plasma
- Thermal plasma

Laser treatment

- CO₂ laser
- Excimer laser

* The use of electromagnetic radiation, plasma and laser for wood modification

Other processes

Biological treatment

- Degradation metabolites
- Fungal incising
- Enzyme treatment
- Bacterial incising
- Natural extracts
- Fungi antagonists

Biomimetics

- Water repellency
- Self cleaning

Mineralisation

- Silica-based
- Carbonate based

Novel media

- Supercritical fluids
- Ionic liquids

New methods

- Graft polymerisation
- Click chemistry
- Rhodium catalysis of hydroxyls
- Modification of chitosan

Wood Modification Chemical Thermal And Other Processes

Antonios N. Papadopoulos



Wood Modification Chemical Thermal And Other Processes:

Wood Modification Callum A. S. Hill, 2007-02-06 This book is exclusively concerned with wood modification although many of these processes are generic and can be applied to other lignocellulosic materials There have been many rapid developments in wood modification over the past decade and in particular there has been considerable progress made in the commercialisation of technologies Topics covered include The use of timber in the 21st century Modifying the properties of wood Chemical modification of wood Acetic Anhydride Modification and reaction with other chemicals Thermal modification of wood Surface modification Impregnation modification Commercialisation of wood modification Environmental consideration and future developments This is the first time that a book has covered all wood modification technologies in one text Although the book covers the main research developments in wood modification it also puts wood modification into context and additionally deals with aspects of commercialisation and environmental impact This book is very timely because wood modification is undergoing huge developments at the present time driven in part by environmental concerns regarding the use of wood treated with certain preservatives There has been considerable commercial interest shown in wood modification over the past decade with products based upon thermal modification and furfurylation now being actively being marketed The next few years will see the commercialisation of acetylation and impregnation modification This is a new industry but one that has enormous potential This book will prove useful to all those with an interest in wood modification including researchers technologists and professionals working in wood science and timber engineering wood preservation and well as professionals in the paper and pulp industries and those with an interest in the development of renewable materials

Wood Modification Technologies Dick Sandberg, Andreja Kutnar, Olov Karlsson, Dennis Jones, 2021-07-14 The market for durable products using modified wood has increased substantially during the last few years This is partly because of the restriction on the use of toxic preservatives due to environmental concerns and to lower maintenance cost and time Furthermore as sustainability becomes a greater concern the environmental impact of construction and interior materials is factored in planning by considering the whole life cycle and embodied energy of the materials used Wood is modified to improve its intrinsic properties enhance the range of applications of timber and to acquire the form and functionality desired by engineers without calling the environmental friendliness into question Wood modification processes are at various stages of development and the challenges faced in scaling up to industrial applications differ The aim of this book is to put together the key elements of the changes of wood constituents and the related changes in wood properties of modified wood Further a selection of the principal technologies implemented in wood modification are presented This work is intended for researchers professionals of timber construction as well as students studying the science of materials civil engineering and architecture This work is not exhaustive but intends to deliver an outline of the scientific disciplines necessary to apprehend the technologies of wood modification and its behavior during treatment as well as during its use Science of Wood

Degradation and its Protection R. Sundararaj, 2022-03-16 This edited book covers all aspects of wood degradation from its formation and growing in trees to its end usages when it is put into human usage. Wood is an age-old traditional fascinating material with a sensory-rich immersive experience that kindles aesthetics and creativity. The utility, durability, and functionality of wood render it a cosmopolitan material. It constitutes an integral part of human lives from ancient times to modern societies, being used by various sectors viz. construction, furniture, panel products, paper, and pulp sports goods, agricultural implements etc. Wood, being a biological material, is susceptible to degradation both by physical and biological means, and the need to protect the wood and prevent heavy economic losses constitutes a major challenge. Also, wood formed by the trees is the major sink of carbon, and the carbon remains locked up for the life of the wood, thereby serving as an important tool to mitigate climate change. But the carbon stored in wood returns to the atmosphere when it degrades and will have a positive effect on climate change. Hence, wood protection, aiming for extending the service life of wood, plays a key role in locking the carbon for a longer period in the wood and also substantially reduces the demand and depletion of forest resources. The book focuses on wood as an important natural bio resource, inventory of wood protection, usage, utilization, preservatives, protection technologies, and wood protection from all forms of degradation. Special focus is given on the eco-friendly way of protecting wood and its importance in mitigating climate change. The book is useful for Indian and international readers who are working in wood domains. It is of interest to wood technologists, teachers, researchers, climate change scientists, capacity builders, and policymakers. It is of immense importance as a guide and study material to the graduate and postgraduate students of wood science in various universities of India and abroad.

Wood Deterioration, Protection and Maintenance Ladislav Reinprecht, 2016-07-27 WOOD DETERIORATION PROTECTION AND MAINTENANCE Wood has low embodied energy, is a renewable resource, and can perform extremely well in a range of construction applications, so it is not surprising that there is growing interest in the use of wood in new buildings. As a natural material, wood can be subject to degradation by a range of environmental factors: insects, bacteria, or fungi. Advances in the understanding of the degradation processes caused by these factors, as well as increased knowledge about boundary environmental conditions and the extractives that suppress the development of timber pests, have led to new methods of structural, physical, and chemical protection of wood and wooden composites. The result is that wood can deliver high performance, long life buildings and structures with low environmental impact at relatively modest cost. *Wood Deterioration, Protection and Maintenance* provides an up-to-date discussion of the natural durability of wood, wood degradation processes, and methods of structural, physical, and chemical protection of wood. The important information relating to wood degradation by abiotic and biotic agents in the context of the basic structure of wood is fully discussed, showing how structural changes in damaged wood relate to physical and mechanical properties. Modern active substances in wood protection and the relationships between preservative properties, the anatomical structure, and moisture content of wood and protective

processes involving pressure and or diffusion driving forces are fully illustrated Mentioned also are principles of wood maintenance together with modes of damaged wood identification sterilization and reconstruction OTHER BOOKS OF INTEREST Wood Modification Chemical Thermal and Other Processes Callum A S Hill Hardback ISBN 9780470021729 January 2006 Wiley Wood in Construction How to Avoid Costly Mistakes Jim Coulson Paperback ISBN 9780470657775 March 2012 Wiley Blackwell Structural Timber Design to Eurocode 5 2nd Edition Jack Porteous Abdy Kermani Paperback ISBN 9780470675007 May 2013 Wiley Blackwell *Processing Technologies for the Forest and Biobased Products Industries* Marius C. Barbu, Alfred Teischinger, 2010 The Deepwater Horizon oil spill in April 2010 has shown us that increasing risks and costs have to be accepted to satisfy the increasing demand of material and energy resources from a worldwide perspective Increasing the recovery of raw materials is one possibility but another one is increasing efficiency in processing and production Therefore the development and improvement of processing technologies is a crucial factor for economic progression This book contains discussions from the 1st International Conference on Processing Technologies for the Forest and Biobased Products Industries held in October 2010 at Salzburg University of Applied Sciences Kuchl Austria The conference provided a forum for discussions among researchers producers and consumers of forest and biobased products and acted as a catalyst for new research on process technologies on quality control and process improvement and on new concepts for use by technical managers operations managers and business managers The book presents an overview of new developments in processing technologies in the forest and biobased products industries Series Austria Forschung und Wissenschaft Technik **Springer Handbook of Wood Science and Technology** Peter Niemz, Alfred Teischinger, Dick Sandberg, 2023-04-01 This handbook provides an overview on wood science and technology of unparalleled comprehensiveness and international validity It describes the fundamental wood biology chemistry and physics as well as structure property relations of wood and wood based materials The different aspects and steps of wood processing are presented in detail from both a fundamental technological perspective and their realisation in industrial contexts The discussed industrial processes extend beyond sawmilling and the manufacturing of adhesively bonded wood products to the processing of the various wood based materials including pulp and paper natural fibre materials and aspects of bio refinery Core concepts of wood applications quality and life cycle assessment of this important natural resource are presented The book concludes with a useful compilation of fundamental material parameters and data as well as a glossary of terms in accordance with the most important industry standards Written and edited by a truly international team of experts from academia research institutes and industry thoroughly reviewed by external colleagues this handbook is well attuned to educational demands as well as providing a summary of state of the art research trends and industrial requirements It is an invaluable resource for all professionals in research and development and engineers in practise in the field of wood science and technology *Advances in Wood Composites* Antonios N. Papadopoulos, 2020-04-17 Wood composites have shown very

good performance and substantial service lives when correctly specified for the exposure risks present Selection of an appropriate product for the job should be accompanied by decisions about the appropriate protection whether this is by design by preservative treatment or by wood modification techniques This Special Issue Advances in Wood Composites presents recent progress in enhancing and refining the performance and properties of wood composites by chemical and thermal modification and the application of smart nanomaterials which have made them a particular area of interest for researchers In addition it reviews some important aspects in the field of wood composites with particular focus on their materials applications and engineering and scientific advances including solutions inspired biomimetrically by the structure of wood and wood composites This Special Issue with a collection of 13 original contributions provides selected examples of recent Advances in Wood Composites

Impact of process conditions in open and closed reactor systems on the properties of thermally modified wood Michael Altgen, 2016-12-05 Various thermal wood modification technologies have been developed in Europe during the past decades that differ notably in the process conditions applied However the changes in wood properties by thermal modification the underlying modes of action and their link to the process conditions are still not fully understood This thesis investigates the influence of different process conditions in open and closed reactor systems on the resulting properties of thermally modified wood In closed reactor systems elevated water vapor pressure accelerates the thermal degradation of wood polymers and results in high mass loss levels even at mild treatment temperatures However in addition to the loss in wood mass a strong influence of drying and softening of wood at elevated temperatures as well as an increased cell wall matrix stiffness by modification of the lignin carbohydrate complex under dry heat conditions influences the wood properties i e water sorption For wood thermally modified in open reactor systems at different peak temperatures and durations the surface performance is investigated with regard to the susceptibility to surface cracking photodegradation and coatability The results provide explanations why the performance of thermally modified wood in exterior applications does not always meet the expectations derived from its enhanced resistance against decay fungi

Proceedings of MPCPE 2022 Nikolai Vatin, Svetlana Roshchina, Dmitrijs Serdjuks, 2023-10-17 This book gathers selected contributions in the field of civil and structural engineering as presented by international researchers and engineers at the International Conference on Materials Physics Building Structures and Technologies in Construction Industrial and Production Engineering MPCPE held in Vladimir Russia on April 26-28 2022 The book covers a wide range of topics including the theory and design of capital construction facilities engineering and hydraulic structures development of innovative solutions in the field of modeling and testing of reinforced concrete metal and wooden structures as well as composite structures based on them investigation of complex dynamic effects on construction objects and many others directions Intended for professional builders designers and researchers The contributions which were selected by means of a rigorous international peer review process highlight numerous exciting ideas that will spur novel research directions and foster multidisciplinary collaborations

Recycled

Plastic Biocomposites Md Rezaur Rahman, Muhammad Khusairy Bin Bakri, 2022-01-24 Recycled plastic biocomposites have attracted widespread attention from both researchers and manufacturers due to the significant improvements in their physico mechanical thermal rheological and barrier properties when compared to conventional materials as well as their potential regarding commercialization and zero waste Recycled Plastic Biocomposites presents the latest information on recycled polymers textiles pulp and paper wood plastic rubber waste plastic and micro and nano effects of recycled plastic waste resources that have great potential as reinforcement materials in composites because they are non toxic inexpensive biodegradable cost effective and available in large amounts Recycled plastic biocomposites are now starting to be deployed in a broad range of materials applications due to their advantages over petroleum based materials Currently there are no limits to the possibility of their applications They also have exceptional sustainable and biodegradable properties when compared to conventional materials such as polymers and composites Recycled Plastic Biocomposites reviews the latest research advances on recycled plastic based biocomposites including thermoplastic thermoset rubber and foams In addition the book covers critical assessments on the economics of recycled plastic including a cost performance analysis that discusses its strengths and weaknesses as a reinforcement material The huge potential applications of recycled plastic in industry are also explored in detail with respect to low cost recyclable and biodegradable properties and the way they can be applied to the automotive construction and packaging industries The life cycles of both single and hybrid recycled plastic based polymer composites and biocomposites are also discussed in detail From the viewpoint of recycled plastic based polymer composites the book covers not only the well known role of recycled polymers and composites but also advanced materials produced from micro nano and pico scale fillers that achieve better physical mechanical morphological and thermal properties This book will be an essential reference resource for academic and industrial researchers materials scientists and those working in polymer science and engineering chemical engineering manufacturing and biocomposites Places an emphasis on micro nano and pico scale fillers that significantly improve properties Discusses the most suitable fabrication methods properties and applications Features critical assessments on the economics of recycled plastic including a cost performance analysis that reviews its strengths and weaknesses as a reinforcement material

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Wood Modification Chemical Thermal And Other Processes Introduction

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