



Performance of Bio-based Building Materials

Edited by Dennis Jones and Christian Brischke

Performance of Bio-based Building Materials provides guidance on the use of bio-based building materials (BBBM) with respect to their performance. The book focuses on BBBM currently available in the European market and presents a broad overview of the topics relevant for application and promotion of these materials in construction.

Chapters cover both 'old and traditional' BBBM since quite a few of them are experiencing a comeback on the market. Each chapter contains a general description and notable properties related to performance and applications. Topics include non-wood bio-based materials, test methods for bio-based materials, modelling, evaluation and standardisation. The chapters analyse in detail the material properties, recommended uses, performance expectancies, testing methodologies and related standards.

The book has been written by leading experts working on each material type and will be a valuable reference resource to those working in the bio-based materials research community, such as architects and agencies dealing with sustainable construction and graduate students in civil engineering.

Dennis Jones, the Chair of COST Action FP1303, has 20 years of experience in wood and bio-based material research and technology. Currently a consultant, as well as being associated with Luleå University of Technology in Sweden and the University of Primorska in Slovenia, he has also worked in the UK, Denmark, The Netherlands and Sweden. Christian Brischke is the Vice Chair of COST Action FP1303 and is a Researcher at The University of Göttingen in Germany. He has a prolific publication list in areas linked to protection and performance of bio-based materials.



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Preface

The 'bio-based economy' represents an increasing area of development globally and covers a wide range of activities incorporating bio-based materials. 'Bio-based' in this context means that the materials and products are derived/made from renewable resources, with the criteria that a renewable resource recovers faster than it is drained, in contrast to many mineral and fossil resources. The processing of the forest biomass into value-adding and durable building materials and products, also taking into account the by-product streams, clearly fulfils these criteria today and with proactive strategies also in the future. In addition to this, compared with aluminium, steel and concrete, most such bio-based materials are made with considerable lower energy consumption, and their use acts as a carbon sink, which means that a replacement of materials made from nonrenewable resources directly reduces CO₂ emissions. The future strategies for the world's energy and material supply must consider these facts since some prognoses indicate that the fast growth of the bioenergy sector could result in a higher use than growth of Europe's forest and agricultural biomass.

The development of building materials incorporating bio-based materials is also an area of rapid development. Solid timber, wood fibres and other materials, such as bamboo, miscanthus, phragmites and other gramineae, are now being used for structural purposes and for roofing and cladding, and there are many textbooks and reference articles related to their use. In particular, the combined use of wood-based and other bio-based materials allows the configuration of diverse composites, such as particle and fibreboards, sandwich panels or in combinations with polymers as extruded profile members (*WPC* and *BPC*) and shaped components. Traditional agricultural food plants also have the potential being used for various building applications, for example, lightweight building boards or insulation wall fillings. Flax, hemp, sisal, coir, corn cobs and rice or wheat straw are just a few examples of biofibres used in different applications in the building trade. Wood itself is not only used in its native character but also chemically and thermally modified. Finally, the use of classical and new preservatives allows the use of timber products even under severe outdoor exposure conditions.

This textbook represents one of the key outcomes from *COST* Action FP1303 (Performance of bio-based building materials). Founded in 1971, *COST* (European Cooperation in Science and Technology) is the first and widest European framework for the transnational coordination of nationally funded research activities. *COST* enables breakthrough scientific developments leading to new concepts and products and thereby contributes to strengthen Europe's research and innovation capacities. It is a unique means for European researchers to jointly develop their own ideas and new

initiatives across all scientific disciplines through trans-European networking of nationally funded research activities. Among the key features of COST are

- building capacity by connecting high-quality scientific communities throughout Europe and worldwide
- providing networking opportunities for early career investigations
- increasing the impact of research on policymakers, regulatory bodies and national decision makers, as well as the private sector

The book reviews many of the key properties of bio-based materials and how these materials are becoming materials of choice within modern construction methods. It will consider the current needs and how materials are currently being used, with emphasis on how the material performs during its service life. It brings together the combined knowledge and expertise across the European scientific community leading activities into the use of bio-based materials within construction and aims to provide guidance to these materials and how they perform when used correctly.

Dennis Jones
Christian Brischke

Acknowledgement

European Cooperation in Science and Technology (*COST*) is a pan-European inter-governmental framework. Its mission is to enable breakthrough scientific and technological developments leading to new concepts and products and thereby contribute to strengthening Europe's research and innovation capacities. It allows researchers, engineers and scholars to jointly develop their own ideas and take new initiatives across all fields of science and technology while promoting multi- and interdisciplinary approaches. *COST* aims at fostering a better integration of less research-intensive countries to the knowledge hubs of the European research area. The *COST* Association, an international not-for-profit association under Belgian Law, integrates all management, governing and administrative functions necessary for the operation of the framework. The *COST* Association has currently 36 member countries (www.cost.eu).

‘This book is based upon the work from *COST* Action (FP1303, performance of bio-based building materials)’.



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