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Editorial

Special Issue "Wood Modification: Characterization, Modelling, and Applications"

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Wood has been recognized as an attractive alternative to several other traditional construction solutions, and it is often called the "building material of the 21st century". However, compared with other traditional materials, wood possesses some technical limitations and properties that, because they are less understood, remain difficult to control. The most problematic are low-dimensional stability, thermal steadiness, limited fire resistance, biotic and abiotic degradation resistance, and varying mechanical properties highly affected by the morphological structure of wood. These properties need to be improved to further enlarge wood application fields as well as reinforcing the confidence of architects, engineers, and consumers when using wood. New developments in the field of wood modification resulted in the discovery of highly innovative materials with enhanced properties for natural timber. Several of these reached the highest readiness level and are now mass-produced in high volumes. Further intensive research is in progress to discover new wood modification solutions to ensure improvement of wood properties and functionality, allowing elongated service life and reducing the risk of unexpected product failure. This Special Issue presents the newest research outcome in the field of the enhancement of native wood properties through a wide range of chemical, biological, and physical agents. It contains two reviews and ten research reports authored by researchers from four continents and 13 countries, namely, Australia, Finland, Greece, Iceland, Iran, New Zealand, Norway, Poland, Romania, Slovenia, Switzerland, the UK, and the USA.

An overview of functional treatments for modified wood is provided in a comprehensive review paper [1]. The manuscript presents two parallel but closely connected aspects of timber modification: the material functionalization strategies combined with the expected (multi)-functionality of timber products. The wide range of covered modification processes and the scope of applications proved that wood modification is not only the sole concern of a few wood scientists but it became a truly inter-disciplinary research area. Novel formulations, characterization methods, and serviceability are presented and deeply discussed in several publications contributing to the Special Issue [2–7]. A broad portfolio of characterization methods can be successfully implemented for the evaluation of complex mechanisms of deterioration process occurring during service life. Artificial [2,3], natural [4,5], and combined [6] weathering methods are used for the assessment of the performance of different substrates and coatings. The performance of wood finished with a broad range of coatings systems is highly improved when compared to that of unmodified wood. This confirms the great advantage of wood surface protection, especially when used in outdoor applications. Investigated coatings included transparent, semi-transparent, and opaque solutions based on different chemical compositions [3,4,6]. The performance of an innovative, bioinspired, and fully biobased coating system containing living fungal cells provides testimony for technological development. [5]. In this case, the desired occurrence of fungi as a part of the coating formulation provides self-healing properties. However,

evidence of unwanted microbial cells is considered a major cause of the failure of timber products in use. Therefore, the fundamentals of fungal decay, staining, and mold growth processes, as well as analysis of the fungal attack mechanisms in the context of the state-of-the-art knowledge, is reviewed [8]. Several suggestions for the future research directions in the new biocidal and non-biocidal coatings treatments are provided. These are essential for creating integrated coatings systems capable of limiting fungal attack while providing long-term protection against environmental factors.

A critical limitation of the natural weathering procedures is the fact that the test is very long-lasting. The novel methodology for the acceleration of the natural weathering test is presented [9]. It can be used for the generation of the weather dose–response models that are essential to estimate the future service life performance of timber elements. Machinability, mechanical properties, and other engineering aspects of the modified wood are addressed with consideration given to the specificity of arctic driftwood [10] as well as laminated wood composites [11]. The diverse positive effects of wood modification may be associated with the high environmental costs of the transformation processes. For this reason, a systematic comparison of the impacts associated with the most relevant modification technologies is presented in a dedicated review [12]. The impact of the expected service life extension, highly imparted by the proper use of modified wood in buildings, is simulated and profoundly discussed.

The broad spectrum of topics presented in this Special Issue provides a comprehensive update regarding ongoing research in this field. We do sincerely believe that such a compilation can be an inspiration for the further development of multifunctional and sustainable coatings, revolutionizing the wood sector of the future.

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