Application of Wood Composites

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Wood composites are the key material for a number of structural and non-structural applications for interior and exterior purposes, such as furniture, construction, floorings, windows and doors, etc. They can be successfully produced with predetermined specific properties matching the required end uses. Wood composites ranging from fiberboard to laminated beams need to be better known, and more attention must be paid to their research. Laboratories worldwide do innovative research, and new challenges, approaches, and ideas are continuously increasing, allowing us to mirror an exciting and interesting research future [1–4].

The time when this Special Issue had been continuously compiled was mostly a stressful period for all of us, marked with the widespread outbreak of the COVID-19 pandemic, but we hope all *Applied Sciences* readers are healthy and well. We do see a glimmer of hope to return to normalcy on the horizon.

This Special Issue "Application of Wood Composites" addressed various aspects of these important wood materials' use, e.g., mechanical processing of wood composites including their cutting, milling, or sanding incorporating the current analysis of wood dust or grain size measurements and composition of particles [5–9], scientific views on the influence of various adhesives in the creation process of wood composites and the analysis of their behavior in contact with various wood elements under different conditions [10–14], the analysis of input raw materials forming wood composites, including various wood species, but also non-wood lignocellulosic raw materials and, last but not least, the analysis of bark, which in the recent years has become an important and promising raw material involved in the construction of wood composites [15–19]; the study of the development of the sliding table saw also suitably complements this Special Issue [20].

If we take a closer look at the main topic of this publication, it is clear that wood composite materials are engineered and produced with tailored physical and mechanical properties appropriate for a wide variety of applications, known or not discovered yet. Additionally, indeed, the utilization of wood composites in various areas has increased recently due to their outstanding properties, allowing them to successfully and sustainably replace solid wood and other conventional materials. We have tried to respond to this newly created situation with this publication.

One of the publications was aimed at providing the reader with new information on the recent practices in laser cutting of wood and wood composites, and determining the optimal set of cutting parameters by a method of a low-power CO₂ laser in particular. Three factors were investigated, namely the effect of the laser power, cutting speed, and number of annual rings [7]. Other new insights are emerging in another type of wood processing: Sanding. The research results indicate that the factors determining sanding efficiency are the type of wood, and, secondly, the grit size of sanding belts. Maximum sanding efficiency for the softwood surface of wood composites ranged from 1 to 2 min, while for the hardwood species composites surface, it ranged from 2 to 4.5 min at the start of sanding and then decreased [5]. The accompanying phenomenon of sanding is wood dust that poses a serious threat to the health of workers and employees as well as a significant fire and explosion hazard; it accelerates the wear of machines, worsens the

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quality of processing, and requires large financial outlays for its removal [21]. Therefore, the aim was to investigate the extent to which the grit size of sandpaper influences the size of the wood dust particles and the proportion of the finest particles which may constitute the respirable fraction [10]. The grain size measurements of wood dust samples from selected tropical wood species were investigated, as well as the conditions under which wood composites are processed, e.g., impact of thermal modification of wood composites surface saturated by steam and its influence on the particle size distribution of the sawing and milling process [8,9].

It is remarkable how many opportunities will arise when using modern methods and high-quality instruments and equipment for the analysis of wood composites. With a compact Time-of-Flight Secondary Ion Mass analyzer, integrated in a multifunctional focused-ion beam scanning-electron-microscope, it was possible to show that the Ga^+ ion source could be detected and visualized in 3D ion molecular clusters specific to polymeric 4,4'-diphenyl methane diisocyanate (pMDI) adhesive and wood [10]. The bonding of wood with assembly adhesives is crucial for manufacturing wood composites. Various adhesives in the context of their application to various types of wood must be analyzed for the formation of quality wood composites, e.g., polyvinyl acetate (PVAc), lignin-based formaldehyde-free adhesives (lignosulfonates), or new and improved adhesive mixtures of urea-formaldehyde (UF) resin, e.g., with soy flour [11,12]. It has been shown that the properties of wood composites can be improved by using these new and less used combinations of adhesives. The fabricated wood composites achieved close-to-zero formaldehyde content of 1.1 mg/100 g, i.e., the super E0 emission grade (≤ 1.5 mg/100 g), which allowed their classification as eco-friendly, low-emission wood-based composites [13,14,22,23].

Without a detailed analysis of input raw materials, it is not possible to form meaningful wood composites. The analysis of input wood raw materials must be carried out no matter what kind of wood composites are produced. The surface roughness constitutes one of the most critical properties of wood veneers for their extended utilization, affecting the bonding ability of the veneers with one another in the manufacturing of wood composites, the finishing, coating and preservation processes, and the appearance and texture of the material surface. The surface roughness was examined by applying a stylus tracing method on typical wood structure areas of each wood species, as well as around the areas of wood defects (knots, decay, annual rings irregularities, etc.), to compare them and assess the impact of the defects on the surface quality of veneers [18]. The production possibilities of oriented strand boards (OSB) in the laboratory from a mixture of softwood species and hardwood species were tested [16]. In our times, it is becoming increasingly important to use secondary products in wood processing or to use less known and less used lignocellulosic materials as sustainable alternatives of wood [24–26], such as the bark of various woody plants which has not been fully utilized yet, or utilization of walnut and hazelnut shells which are agricultural by-products, available in high quantities during the harvest season. Very interesting and promising research results were achieved [17,19]. As invasive alien species are one of the main causes of the loss of biodiversity, and thus of changes in ecosystem services, it is important to find the best possible solution to their usability. Research showed that it will be possible to deal with such a problem as well and the production of wood plastic composites is a viable solution [15].

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It is good that such a book publication was created. The topic “Application of Wood Composites” is still relevant, new possibilities for application of wood composite materials are emerging, and therefore it is understandable that MDPI has already opened access to a new Special Issue “Application of Wood Composites II” within the journal Applied Sciences with the possibility of publishing new high-quality original research articles and reviews on the latest advancements in wood composites materials and their applications.

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