

Wood, the Most Interesting, Innovative and the Best Material for Our Society

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Abstract

Wood is the only material which is renewable, recyclable, biodegradable, and the most suitable material for creation of beautiful, sustainable and earth friendly products. High valued physical, mechanical, environmental and aesthetic properties are unique only to wood. In terms of its use, wood has been serving humans as a superior material for centuries. Examples are easy to find from great inventions of the past to the most interesting and futuristic nano-scale wood products; and from the great architectural wonders of ancient civilizations to the contemporary structures with the most favorable ecological footprints. Despite its vast importance, wood is currently undervalued as an essential ecological material for the future. Therefore, there is a need to rediscover its uniqueness in order to better understand its large potential and importance in our societies. Wood should be more appreciated and promoted for variable uses in almost every aspect of our lives.

Keywords: wood - renewable, recyclable, biodegradable material; nano-scale wood products

Introduction

Wood is the only renewable, recyclable, biodegradable material. It is also highly recommended material suitable for creation of beautiful, sustainable and earth friendly products. Yet, there is an ever growing trend—lack of interest in wood products by the modern generation and that wood and wood products trade are losing its importance. Therefore there is a strong need to remind all potential users and the general public of reasons why wood is the greatest material out there.

Superior Material Properties

Combination of highly valued physical, mechanical, aesthetic and environmental properties are unique only to wood. Numerous technical textbooks have been written about this subject and are used mainly by academic audience (Haygreen and Bowyer 1996). Some properties are going to be highlighted because of their relevance to a broader spectrum of users such as: architects, designers, product developers, artists or craftsmen whom should remain interested in wood material (Fig.1).



Figure 1. Wood is the unique material used by variety of users: architect, designer, product developer, artist or craftsmen.

Physical properties such as - broad spectrum of natural colors, texture, variable density, odor, thermal conductivity, acoustic insulation, electrical, nano-dimensional properties, friction, nuclear and others are reasons why wood is used in so many unique applications (Fig. 2).



Figure 2. Examples of unique application of wood using its physical proprieties.

Properties such as wood - moisture relation and its result in dimensional instability could be perceived negatively, yet it could be also used as an advantage by the clever designer.

Green furniture makers (Shea1971, Alexander 197) used shrink and swell techniques to built furniture which will get stronger over time (Fig. 3).



Figure 3. Shrink and swell joinery examples used in Shaker's furniture, oriental furniture and school furniture.

For many users, wood is perceived as a challenging material and yet there is a great need to understand the behavior of this orthotropic material. Empirical knowledge of proper wood utilization is apparent in many great masterpieces created in the past (Jackson 1989). In contemporary applications it is often detected that a lot was forgotten. However, not even suitable application could be solved with advanced finishes and treatment that could convert the hygroscopic nature of wood into a product with water resistant or even waterproof properties. Just as an example, wood was and still is used for functional bathtubs (Fig. 4).



Figure 4. a) Traditional bathtub, b) & c) contemporary bathtub designs.

Mechanical properties – variable strength based on different wood species, elastic properties such as flexibility, bendability and durability contributed to many products with long lifespan and great performance. Man contributed immensely to engineering properties of wood with the ability to form a variety of wood-based composite materials, which are created from big or small wood particles or residues. These materials are more uniform with specifically designed strength properties. They are more and more utilized to create unique small and large scale structures (Fig. 5).



Figure 5. Examples of composite materials and their use in unique furniture.

Bending wood - with help of some plasticization treatment, craftsmen bent wood for centuries (Gehry 1992). Compression bending is an example of how we could obtain incredible shapes made of wood (Fig. 6).

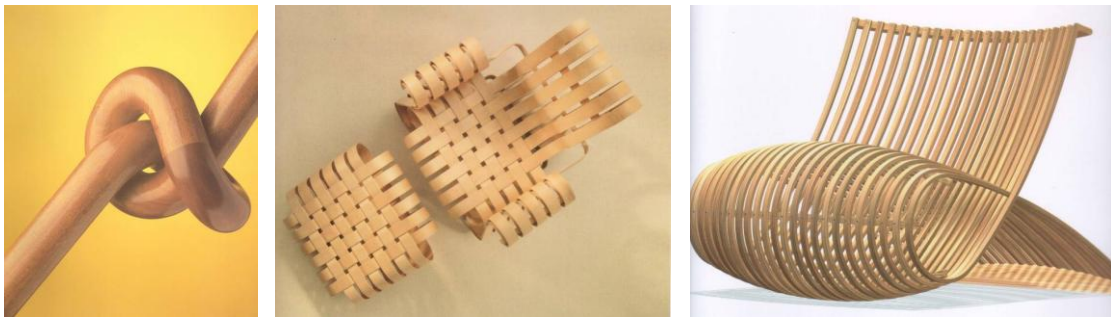


Figure 6. a) Compression bending and b) & c) furniture by Frank Gehry.

Aesthetic properties - among many are variability in appearance based on color and texture, natural soothing feel, warmth and comfort. Wood is a material with status, graceful aging, and with presence of unique character marks. Above all, wood is the material of superior workability, chosen by many craftsman and artists (Lefteri, 2003).



Figure 7. Examples of aesthetic properties are in a) graceful aging of musical instruments, b) workability, and c) use of character marks in art objects.

Environmental nature or wood - is described by renewable, recyclable, biodegradable, sustainable (green) material properties. Wood can be by design slow or fast grown material and has an ability to be preserved for centuries in durable products (carbon sequestering) (Bowyer 2012). Results of Life Cycle Analysis (LCA) are also showing the superiority of wood when compared to other non renewable materials for environmental applications. Nevertheless, heating power and energy from wood residues is an important attribute in today's world.

Wood Utilization

In terms of its use, wood has been serving humans as a superior material for centuries. Examples are easy to find from great inventions of the past to the futuristic nano-scale wood products. Wooden artifacts with superior construction were found in Egyptian tombs (Desroches – Noblecourt 1963). Ancient drawings are documenting how need for wood conquered and transformed the world (Fig. 8).

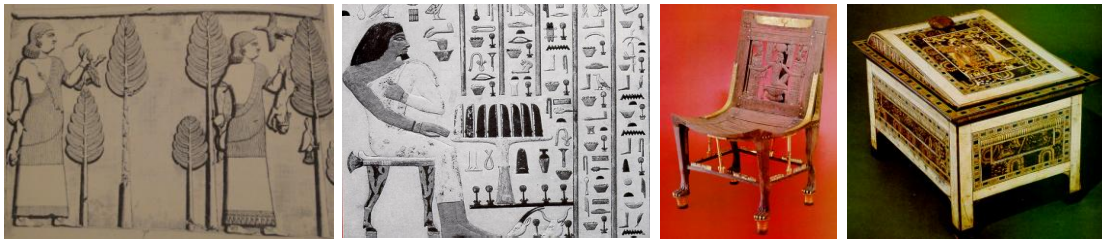


Figure 8. a) Timber procurement by Uruk civilization, b) & c) & d) Egyptian furniture.

Ship building needed to secure power, expanding empires built cities and towns, metallurgy, glass production, and even a taste for sugar lead to massive deforestation—a movement to a new world with abundant wood resource and consequently to a massive shift of power. This was a repetition of an age-old process that has occurred again and again until today (Perlin 1989). However, we can learn from past mistakes and break out the cycle of deforestation and land degradation that undermined earlier civilizations by responsible use of natural resources and practicing recycling, renewability principles, and applying healthy policies.

Wood for transportation - wood made trade possible from ancient to present times. Ships, chariots, carts, wagons, and other transportation vessels were made for centuries from wood (Fig. 9). It was and still is a priced commodity.

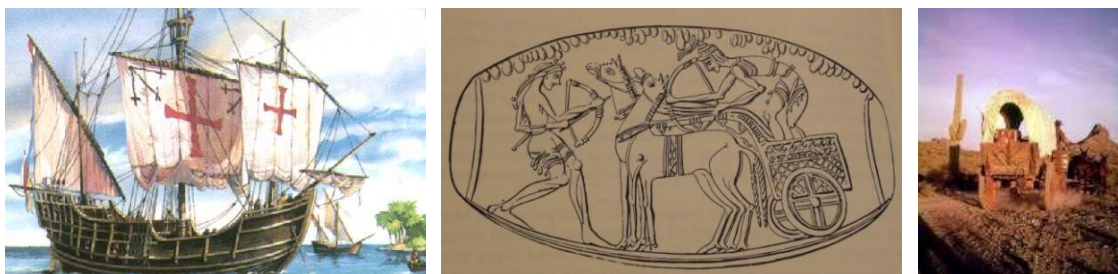


Figure 9. Wood for a) ship building, b) chriots and c) vavons.

Wooden tools, equipment, and musical instruments - before steel was used, high density wood was used for the most intricate machines. Woodworking tools are still made of wood. Its flexibility and strength is still valued in sports equipment such as baseball bats, skate boards, hokey sticks and others. Acoustic properties of wood for production of musical instruments are perceived more like an art than science but proper selection of wood material is essential for production of high quality musical instruments (Fig. 10). For example, the guitar body is often made of spruce and maple, but components such as the bridge could be made of ivory, ebony or other priced woods while protecting endangered woods is enforced.



Figure 10. a) Ash baseball bat b) Chinese musical instrument, c) bass acoustic guitar

Wood for incense - sandalwood was prized as an incense wood in China. Phoenicians cut down cedars for export to Egypt (Perlin 1989). Cedar was traded by early civilizations and is still used today as an incense material for closets. Wood in general is claimed to have bacteria eliminating properties and is often used for cooking utensils (Fig. 11).



Figure 11. a) b),c) Culinary utensils, d) cedar wood shoos incense.

Non wood forest products - such as bamboo is growing one meter a day and is an important material with more than 1,000 uses. Rattan and other similar materials are also of high importance.

Wood for structures – are everywhere from the great architectural wonders of ancient civilizations to the contemporary structures with the most favorable ecological footprints. Examples are endless such as London Olympic Velodrom (Fig. 12a), England; Metropol Parasol in Sevilla, Spain (Fig. 12b); Westminster Hall, in London England; Sakyamuni Temple in Shanxi province, China; China's oldest surviving fully-wooden pagoda Fugong Temple (Fig. 12c); the Hanging Temple of Mount Heng and in Shanxi province, China which was built from local hemlock forests over 50 meters up the side of a sheer cliff in 491A.D. How and why it got there? Wood as a material is also suitable for contemporary modular concepts, organic or biodegradable structures and modern homes with favorable eco footprints.

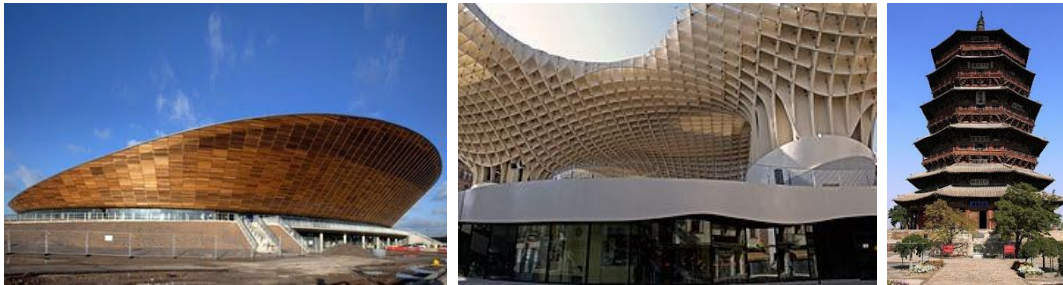


Figure 12. a) London summer Olympic veldrome, b) Metropol Parasol in Sevilla, c) The Fugong Temple Wooden Pagoda.

Wood for prized objects- wood shaping of any kind, especially wood carving into artistic object is the best example how ageless value could be added to a natural material (Fig. 13). For example, furniture from Egyptian tombs is still relevant in terms of structural integrity and could easily compete with any contemporary furniture in terms of its strength and durability. Furniture evolved from prehistoric times and during all architectural periods, wood has remained an essential material for its construction. There is a big lesson to be learned from many of these objects and hopefully preserved for future generations.



Figure 13. a) Chair from tree trunk, b) horse and c) face carvings.

Conclusions

Despite its vast importance, wood is currently undervalued as an essential ecological material. Therefore, there is a need to rediscover its uniqueness in order to better understand its large potential and importance in our societies. Wood should be more

appreciated and promoted for variable uses. There is a large amount of products made of wood and as we say, wood is with us almost every moment of our lives from cradle of wood to wooden casket.

To cultivate love and passion towards wood as a superior material and to teach students and the general public how to use it responsibly and to its full potential is an obligation of every educator in the forest products field. Let me present few examples from the Wood Research Laboratory at Purdue University, USA, where wood products design is approached in combination of aesthetic, strength, manufacturing and environmental design concepts (Fig. 14).



Figure 14. Examples of students design work at Purdue, WRL.

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