

## SPECIFICATIONS OF ECO-MATERIALS AND THEIR INFLUENCE IN THE DESIGN OF MODERN FURNITURE

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**Abstract:** The materials are an important segment of everyday life and their choice in the production of products is of a great importance. The choice of materials is influenced by certain technical requirements that are necessary to be met, and those requirements are density, strength, temperature stability, price, and material resistance.

According to the origin, the materials are divided into natural/eco-materials and artificial/conventional. Eco materials are natural resources that are obtained directly from nature and can have a variety of benefits in the design of the home. The human and nature's symbiosis is an important foundation in the modern design industry. Adding the same to the home brings the warmth felt in nature. In the manufacture of modern furniture the following eco-materials are used: wood, stone, leather, metals, bamboo, cork and natural fibres. All these materials provide a pleasant ambience that is in harmony with nature without harming people's health.

The wood used in the manufacture of furniture introduces warmth, naturalness, and attractiveness.

The natural stone most often has a decorative role in the making of furniture.

Natural leather is used for upholstery of furniture to add comfort and softness.

Metal is used in furniture in order to give a special look.

The bamboo has a significant role in furniture manufacture and is characterized by high toughness, easy processing, and durability.

The cork, besides being used for insulation, has also been used in the manufacture of furniture, as well as decorative material.

Natural fibres are used for upholstery of furniture and as floor coverings.

**Keywords:** materials, sustainable materials, eco-friendly design, modern furniture, aesthetics, functionality, harmony.

### INTRODUCTION

*The material* is a solid substance that has a mass and takes up space and products are made from it in order to be used. According to the origin, materials are divided into natural and artificial.

The term '*eco-materials*' covers the resources that derive directly from nature and can be used for various projects at home editing.

*Natural / eco-materials* include wood, stone, metal, leather, bamboo, natural fibres, etc.

On the other hand, the *artificial/conventional materials* derive from natural materials by adding some other impurities, in order to obtain more economical materials whose characteristics cannot be compared with those of the natural. The artificial/conventional *materials* include metal alloys, polymers, composites, technical ceramics, superconductors etc.

The essence in the selection of eco-design materials is based on the analysis of the application of the object, the expected lifespan, the burdens on which the object will be subjected, and the fulfillment of the heat requirements. (Mike Ashby, Kara Johnson Elsevier, 2002).

When selecting materials, the following synthetic criteria should be considered:

Criteria	Specifications
<b>Ecological</b>	<ul style="list-style-type: none"> <li>➤ Embodied energy</li> <li>➤ Percentage of reuse of waste</li> <li>➤ Percentage of waste processing</li> <li>➤ Percentage of use as filling Earth</li> <li>➤ Fuel consumption during transport</li> </ul>
<b>Thermal comfort</b>	<ul style="list-style-type: none"> <li>➤ Specific heat</li> <li>➤ Thermal conductivity</li> <li>➤ Thermal diffusion</li> <li>➤ Vapor permeability factor</li> </ul>
<b>Mechanical forces</b>	<ul style="list-style-type: none"> <li>➤ Compressive strength</li> <li>➤ Bending strength</li> <li>➤ Tensile strength</li> </ul>
<b>Expense</b>	<ul style="list-style-type: none"> <li>➤ Price</li> </ul>

Table 1: Synthetic criteria and specifications of finishing materials

## 1. GENERAL CHARACTERISTICS OF ECO-MATERIALS

Today, the variety of materials and ideas is huge, so you need to pay more attention to the features that need to satisfy

them. (David Pearson, 1989). The graphic presentation presents the characteristics of eco-materials:

Specifications of eco – materials					
to be eco - friendly	don't consume energy during transport	don't waste a lot of energy while building	to possess high insulating qualities	to be recyclable	to have positive effects on the environment

Figure 1: Specifications of eco – materials

Starting from the fact that eco-materials should not be harmful to users actually means:

- To be free of polluting and toxic components;

- Not to be radioactive;
- Not to be electromagnetic (Spiegel, Ross and Dru Meadows, 2006)

### 2.1. USE OF ECO - MATERIALS IN THE DESIGN OF MODERN FURNITURE

The term *modern furniture* refers to furniture that was produced in the late 19th century, under the influence of modernism. The choice of furniture is a significant feature with which the individual expresses

its individuality in the interior. In order to achieve a satisfying interior look, it is essential the furniture be selected according to quality, design, function, and comfort. Furniture is considered valuable only when the quality of the design, materials and its construction are at the same level as the price.

In the manufacture of modern furniture the following eco-materials are

used: wood, stone, leather, metals, bamboo, cork and natural fibres.

• **WOOD - GENERAL FEATURES**

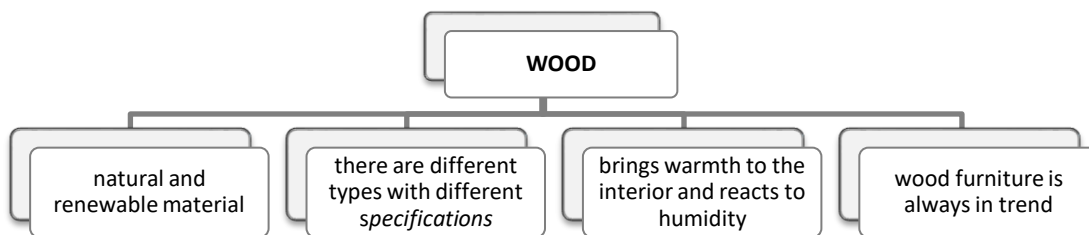


Figure 2: General specifications of tree

The wood is a natural and renewable material, excellent for making furniture and it is always in trend. It is characterized by high toughness, easy manipulation, and maintenance. If it is carefully designed and maintained, the wooden furniture can be used almost infinitely, and because of the

warm colors, as well as the unlimited modeling, it is easily likable. The wood is most often used for the production of corpus furniture, as well as for the preparation of details of some furnishings, thus giving them a special accent.

• **STONE - GENERAL FEATURES**

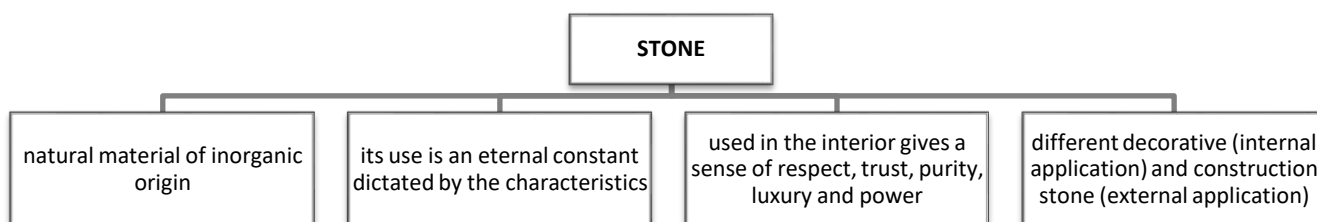


Figure 3: General specifications of stone

The use of the stone is an eternal constant dictated by its characteristics (hardness, resistance, longevity, and easy maintenance) and which gives the user a sense of respect, trust, purity, luxury, and power. Natural stone is a durable and solid material that is widely used in the interiors

because of its easy maintenance, as well as the unique appearance and colors that it has. It is used in the manufacture of furniture (mostly as a working surface), as well as covering floor and wall surfaces. (Josifovska Ruzica, Stefanovska Sonja, 2013)

• **LEATHER - GENERAL FEATURES**

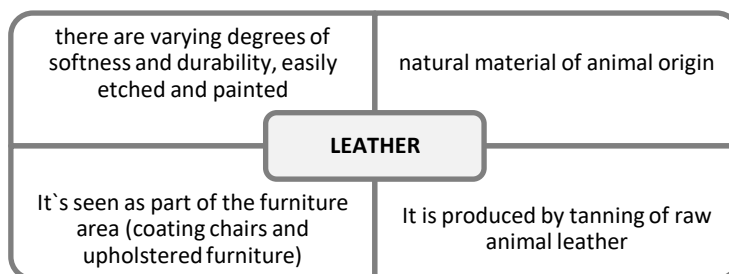


Figure 4: General specifications of leather

The leather is a natural material that is obtained by tanning of animal skin. It is characterized by a different degree of softness and durability and is easy to manipulate. It has been applied since the farthest past as a natural skin, and today it is often replaced with synthetic leather

which is much less expensive, yet it has much weaker qualities than the natural leather. Due to the ability to "breathe", it is mostly used as a material for upholstery or decorating wood furniture. (Todorka Samardzioska, 2015)

• **METAL - GENERAL FEATURES**

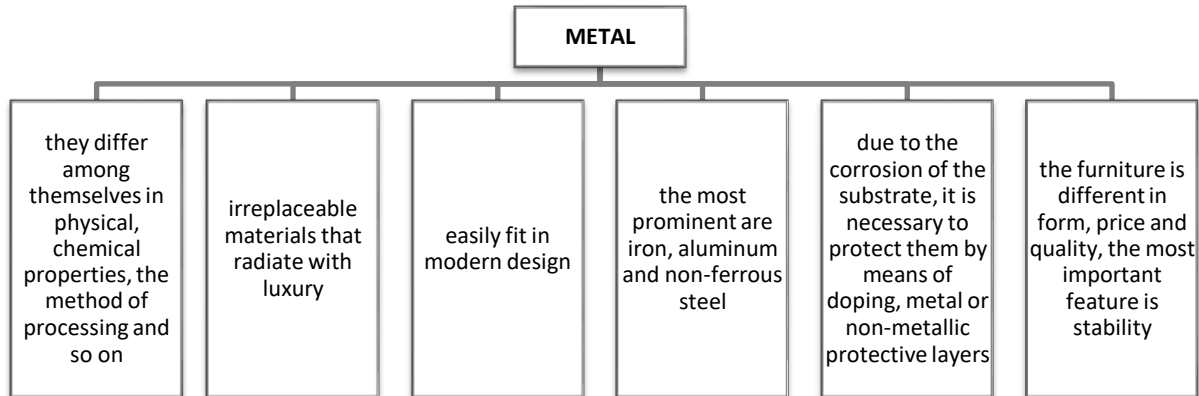


Figure 5: General specifications of metals

Metals as natural materials differ from each other according to the physical, chemical properties, the manner of processing, etc. They are irrefutable materials that radiate with luxury and are easily fitted into the modern design. In the manufacture of furniture, metals have a major role and have been used for

thousands of years. Furniture made of metal is characterized by great secrecy and quality, and the most important feature is its stability. Because it is treated for rust and heat resistance, metal furniture does not require any special maintenance. (Carl J. Nilson, David A. Taylor, 2012)

• **BAMBOO - GENERAL FEATURES**

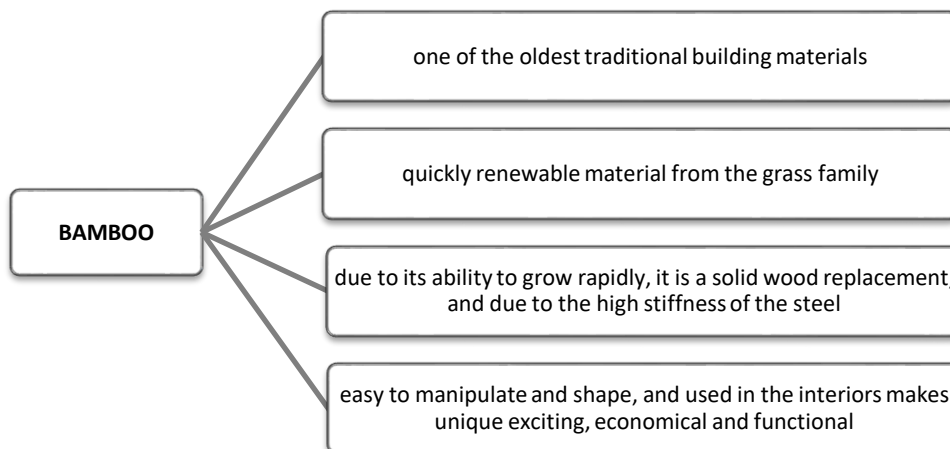


Figure 6: General specifications of bamboo

Bamboo is one of the oldest traditional construction materials, from the grass family. Due to the ability to grow rapidly, it is a profound replacement of the wood, and due to the high stiffness, it is a replacement of the steel. Bamboo is a very beautiful and easily sustainable natural

material that is known for its durability and its beautiful decorative properties. It has a wide range of applications such as window curtains, floor coverings, as well as for making a number of decorative and seating furniture. (Dunkelberg Klaus, 1992)

• **CORK - GENERAL FEATURES**

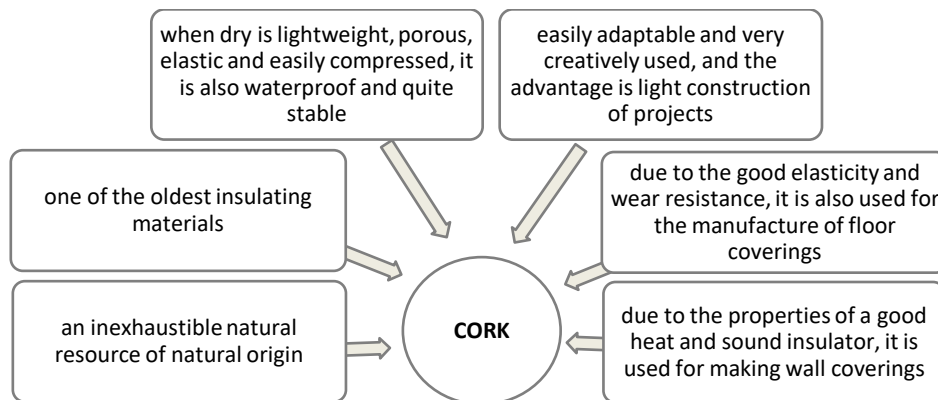


Figure 7: General specifications of cork

Cork is one of the oldest insulating materials. It is an inexhaustible natural resource and a great friend of man in the conservation of nature. As a material, it is easily adaptable and it is quite creative, and the advantage is the light performance of the projects. From it can be made, floor and wall

coverings, jewelry, paintings, etc. Due to the properties of a good heat and sound insulator, it is used for making wall coverings, and due to the good flexibility and wear resistance, it is used for the manufacture of floor coverings.

• **NATURAL FIBRE - GENERAL FEATURES**

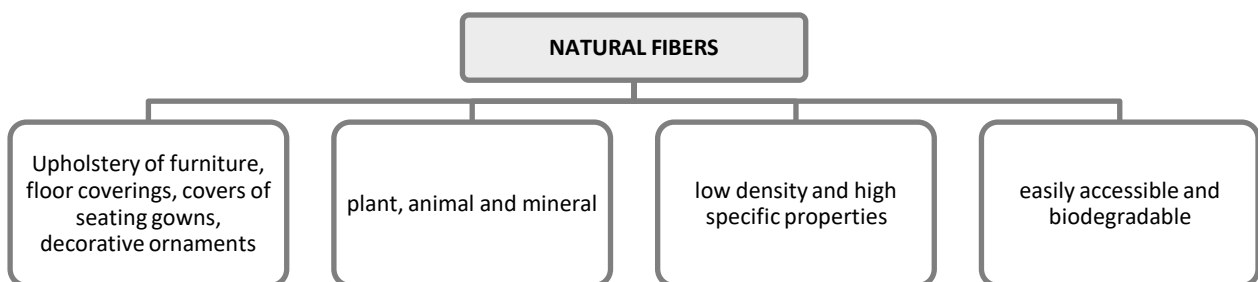


Figure 8: General specifications of natural fibers

Recently, natural fibres have attracted attention due to the advantages they have in terms of conventional materials. They are easily accessible and biodegradable. They are characterized by low density and high specific properties. Their positive features, such as high toughness, good specific strength, low price/performance ratio, and above all

biodegradability, make them an eco-friendly substitute for conventional fibres. They are commonly used for making furniture covers, as well as for making carpets and rugs. (Emilija Fidancevska, Vineta Srebrenkoska, 2009)

## 2.2. THE INFLUENCE OF ECO-MATERIALS IN THE DESIGN OF MODERN FURNITURE

In the design of modern furniture, eco-materials are timeless materials that are always in trend. As natural materials, they have positive characteristics on human's health and the environment, but also with unmatched quality and durability.

Nowadays, as their replacement, artificial materials are used, which can be found at a lower price, but their

characteristics are incomparable to those of natural (eco) materials.

The most important characteristic of eco-materials is their specific natural beauty, so no artificially created material will look like the natural one. They incorporate the nature in every aspect of life, giving it a relaxed atmosphere that fits with the fast and dynamic pace of modern living, and making the home a place where peace can be found out of the everyday responsibilities.

Material	Types used in furniture production	Use of material in the manufacture of furniture	The interior style in which it finds use
<b>WOOD</b>	<ul style="list-style-type: none"> <li>• Solid deciduous trees (walnut, oak, cherry, maple and birch)</li> <li>• Exotic coniferous trees (ebony, mahogany, rosewood tree)</li> <li>• Soft evergreen trees (pine, spruce, spruce, cypress, cedar, sesquia)</li> </ul>	<ul style="list-style-type: none"> <li>• Housings (closets, bureaus, wardrobes)</li> <li>• Decorative elements of furniture</li> </ul>	<ul style="list-style-type: none"> <li>• Industrial</li> <li>• Scandinavian</li> <li>• Nautical</li> <li>• Bohemian</li> <li>• Shabis chic</li> <li>• Farmers</li> <li>• Urban fashionable</li> </ul>
<b>STONE</b>	<ul style="list-style-type: none"> <li>• Granite</li> <li>• Marble</li> <li>• Traventine</li> <li>• Porphyry</li> <li>• Sandstone</li> </ul>	<ul style="list-style-type: none"> <li>• Decorative elements of furniture</li> <li>• Working surfaces</li> </ul>	<ul style="list-style-type: none"> <li>• Rustic</li> <li>• Classic</li> <li>• Minimalist</li> <li>• Eclectic</li> </ul>
<b>LEATHER</b>	<ul style="list-style-type: none"> <li>• Beef / veal</li> <li>• Sheep</li> <li>• Goat</li> <li>• Aligator`s</li> <li>• Snake and other.</li> </ul>	<ul style="list-style-type: none"> <li>• Upholstered furniture</li> <li>• Decorative element of wood furniture</li> <li>• Decorate</li> </ul>	<ul style="list-style-type: none"> <li>• Classic</li> <li>• Minimalist</li> <li>• Eclectic</li> <li>• Traditional</li> </ul>
<b>METAL</b>	<ul style="list-style-type: none"> <li>• Iron</li> <li>• Aluminum</li> <li>• Stainless steel</li> </ul>	<ul style="list-style-type: none"> <li>• Outdoor furniture (for decks and patio)</li> <li>• Brass beds and tables</li> </ul>	<ul style="list-style-type: none"> <li>• Industrial</li> <li>• Scandinavian</li> <li>• Nautical</li> <li>• Urban fashionable</li> </ul>
<b>BAMBOO</b>	<ul style="list-style-type: none"> <li>• There are thousands of bamboo species</li> </ul>	<ul style="list-style-type: none"> <li>• Seating garments</li> <li>• Tables and chairs</li> <li>• Lying</li> <li>• Decorative ornaments</li> <li>• Curtains</li> <li>• Floor and wall coverings</li> </ul>	<ul style="list-style-type: none"> <li>• Asian (Japanese and Chinese style)</li> <li>• Feng shui</li> </ul>
<b>CORK</b>	<ul style="list-style-type: none"> <li>• From the tree</li> <li>• Less common than root</li> </ul>	<ul style="list-style-type: none"> <li>• Decorative elements of furniture</li> <li>• Less often in the making of furniture</li> <li>• Floor and wall coverings</li> </ul>	<ul style="list-style-type: none"> <li>• Industrial</li> <li>• Italian</li> </ul>
<b>NATURAL FIBER</b>	<ul style="list-style-type: none"> <li>• Plant (cotton, kapok tree, flax, jute, hemp, ramie, sisal, raffia and coconut fibers)</li> <li>• Animal (wool, silk, rabbits, goats, camel fibers)</li> </ul>	<ul style="list-style-type: none"> <li>• Upholstery of furniture</li> <li>• Floor coverings</li> <li>• Seat covers</li> <li>• Decorative ornaments</li> </ul>	<ul style="list-style-type: none"> <li>• Industrial</li> <li>• Scandinavian</li> <li>• Nautical</li> <li>• Bohemian</li> <li>• Shabis chic</li> <li>• Farmers</li> <li>• Urban fashionable</li> </ul>

*Table 2: General specifications of eco - materials*

*Wood* as a natural material, used in the manufacture of furniture gives a different dimension to the interior. The most commonly used types of wood are solid deciduous trees (walnut, oak, cherry, maple, and birch), exotic coniferous trees (ebony, mahogany, and rosewood), as well as soft evergreen trees (pine, fir, spruce, cypress, cedar, sequoia). It is used from the farthest past, giving it a stunning and aristocratic appearance. The tree is used in the production of corpus furniture and decorative elements. The wooden elements give special beauty, and the interior is warm and comfortable. As a natural material, it regulates the humidity of the air and positively influences the health of people. The interior styles in which the tree is applied are industrial, Scandinavian, nautical, bohemian, shabby chic, farmland and urban fashion.

*The stone*, as a natural material of inorganic origin, is applied from the farthest past. As a material, it is characterized by durability, endurance, and aesthetics and is always in trend. The most commonly used types of stone are granite, marble, travertine, porphyry, and sandstone. It is used for covering floor and wall coverings, working surfaces, as well as furniture where it is combined with other materials (wood, metal or glass) as a decorative element. Visually enriches the space, giving it a sleek minimalist to luxurious effect. The interior styles in which the stone can be found are: rustic, classic, minimalist and eclectic. (Josifovska Ruzica, Stefanovska Sonja, 2013)

*The term leather* in a technological sense implies a variety of animal skins, which, by processing, increase the resistance to friction, softness, flexibility, improve aesthetic characteristics and the like. The most commonly used types of animal skin are bovine/veal, sheep, goat,

alligator, snake, etc. It is used as a material for covering upholstered furniture and chairs giving a luxurious look. It is also used for upholstery or decorating wood furniture, as well as a decorative element on the walls. The interior styles in which the skin can be found are: classic, minimalist, eclectic and traditional. (Todorka Samardzioska, 2015)

*Metals* as natural materials are obtained from oxide ore from where the oxygen is consumed. Their usage dates back from history. Most of them are unstable and subject to corrosion, so it is necessary to protect them with the help of alloying, metal protective layers and non-metallic protective layers. The most commonly used types of metal are iron, aluminum, and stainless steel. The quality of the metal pieces depends on the way and the attention in their production. They can be processed in a variety of ways, and various forms of refined furniture can be obtained that can fit in almost every environment. Furniture from metal can be found in a variety of forms, prices, and quality, and because of its continuance and artistic tractability. It is commonly found as open-air furniture, as well as brass tables and beds. The main feature of metal furniture is its durability. The interior styles in which metal is applied are: Industrial, Scandinavian, Nautical and Urban Modern (Carl J. J. Nilsson, David A. Taylor, 2012)

*Bamboo* is an excellent source for the manufacture of furniture and it is found in thousands of different types. Due to mechanical strength, easy processing and availability in many tropical and subtropical areas, it is a solid wood replacement, and due to the high stiffness, it is a steel replacement. It is economical, easy to operate and it easily bends and gives the desired shape.



It is used for making seating sets, tables, and chairs, beds, decorative ornaments, curtains, as well as floor and wall coverings. The use of bamboo blinds allows a solid prevention of the permeability of the sun's rays in the home, and with the addition of bamboo as a decorative element, Asian influence on the ambient itself is obtained. The interior styles in which the bamboo is found are Asian (Japanese and Chinese style) and Feng Shui. (Dunkelberg Klaus, 1992)

*The cork* is a product obtained from the tree cork oak (from the tree trunk, and rarely from the root) and it is one of the oldest materials used for insulation. Except as insulating material, due to its easy adaptability and project performance, it finds application in the design of interiors, fashion design, healthcare, and construction industry, making timeless products that are easy to satisfy everyone's taste. During the manufacture of furniture it is seen as a decorative element, and less often for making furniture. The interior styles in which the cork is found are: industrial and Italian.

Nowadays, more emphasis is put on the healthy environment, and the usage of natural fibres, as well as their composite (eco-composites), is increasing. The most commonly used are the fibres (cotton, kapok, akon, flax, jute, hemp, ramie, sisal, raffia, and coir) and animal (wool, silk, rabbits, goats, camel fibres). In the interiors, they are mostly used for the upholstery of furniture, floor coverings (for making carpets and rugs), cloth for the seating furniture and decorative ornaments. The interior styles in which the cork is applied are industrial, Scandinavian, nautical, bohemian, shabby chic, farm, and urban fashion. (Emilija Fidancevska, Vineta Srebrenkoska, 2009)

## CONCLUSION

The material is a solid substance that has a mass and takes up space and products for use are made by it. According to the origin, materials are divided into natural and artificial. Natural (eco) materials carry the epithet of timeless materials that are applied in the design of furniture and interior. Used in the manufacture of furniture they contribute to the preservation of the environment, positively affect the health of the people and provide a more comfortable stay in the room, without causing allergic reactions. Natural / eco-materials include wood, stone, metal, leather, bamboo, natural fibres, etc.

According to the characteristics of the materials, it can be concluded that:

- The main representative of natural materials and at first we are associating with is the tree that is encountered in the interior in different colours and shapes and most often in the manufacture of furniture. Every tree representative is welcome, and the cost is crucial;
- Natural stones are widely used in the interiors because of their easy maintenance, as well as the unique look and colours they have. Commonly used as decorative elements;
- Due to its smoothness and comfort, the skin is most often used to make seating furniture (upholstery), as well as a decorative element on the walls, most often placed in a frame;
- By placing the metal as a decorative element of the room, a special emphasis is given, which is accompanied by strength and courage. They are painted in various colors.



- Bamboo is a material that can easily be shaped and is easily sustainable. It is characterized by durability and ornamentation. It has a variety of applications in the production of a number of decorative as well as seating furniture, as well as for making curtains and flooring.
- Cork is one of the oldest materials used for insulation; it is easily adapted and is quite creative. There is a wide application in fashion, the interior design of the room, as well as the health and construction industry.
- The application of natural fibers is constantly increasing. Their positive features make them an eco-friendly substitute for conventional fibers. They are used for upholstery of furniture and as floor coverings.

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