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木材科学与技术专业英语

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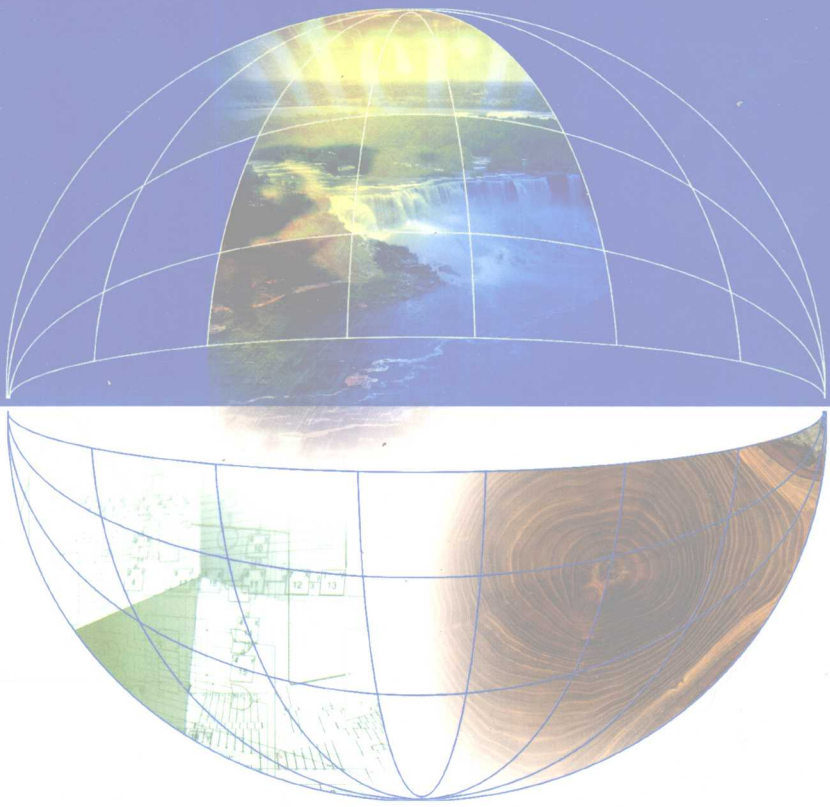

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序

东北林业大学原木材加工专业于1980年较早地开设了《专业外语》课程，旨在巩固学生的外语基础，重点培养专业外语阅读能力。多年实践证明，教学效果显著，是实现培养目标对外语要求的一个有效教学环节。

10年前，作者在教学实践经验基础上，选编出版了《木材加工专业英语文选》作为教材，同时也为科技人员提供了不可多得的专业英语阅读书籍。本书自出版即投入使用以来，发挥了应有的作用，收到了良好的效果，得到了广大学生和科技人员的一致好评，也提出了修改补充的宝贵意见。鉴于科技发展日新月异，专业调整变化明显，教学人员新老交替，为了适应教学改革和形势发展的迫切需要，本书适时地重组了编审人员，修订了选编内容。

随着专业名称的改变，修订再版书名改为《木材科学与技术专业英语》。书的篇幅有所扩大，如增加了单板、其他木制品、功能推动家具设计等新的课文。书的内容有所更新，如删除了木材胶粘剂、胶合板、刨花板、纤维板等课文中的陈旧部分，补充了反映工业发展状况的工艺流程等，尽可能地使本书得到充实提高，渐趋完善。

本书的修订再版，对于健全专业外语教学，加强学生专业英语阅读能力，提高科技人员专业英语水平，促进科学技术发展，将会起到积极的作用，也将会受到读者的喜爱与欢迎。

东北林业大学教授　朱政贤

2002年9月于哈尔滨

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Wood

1. Wood as a Renewable Natural Resource

Wood is the hard, fibrous tissue that comprises the major part of stems, branches and roots of trees belonging to the plant groups known as the gymnosperms and the dicotyledonous angiosperms. Its function in living trees is to transport liquids, provide mechanical support, store food and produce secretions.

Woods are classified as either hardwoods or softwoods, the distinction is botanical and is reflected in details of wood structure. Most(but not all) softwoods are needle-bearing evergreen trees, whereas the hardwoods are broad-leaved trees.

The progress of humanity from the primitive state to the present day's highly advanced technology has been closely associated with dependence on wood. The relative ease of working it and its almost universal availability have made wood an essential material for human survival. Wood has been used for shelter, fuel, weapons, and tools since prehistoric times. As technology developed, wood came to be used for boats, vehicles and bridges.

The annual world production of wood is about 2.4×10^9t, with 10^9t used as industrial roundwood (e.g. sawlogs, veneer logs, poles and pilings, and pulpwood) and the remainder (about 53%) used as

fuelwood and charcoal. Developed and developing countries differ sharply in the ratio of industrial roundwood to fuelwood produced: in developed countries, the percentage of fuelwood and charcoal is, on average 18% of total wood production, in developing countries, it is 80%. In recent years, as energy sources other than petroleum have received increased attention, considerable interest has developed in the use of wood not only as a fuel directly but also as raw material for the production of alcohol and similar sources of energy. The forest products industry is in a unique position to use its own wood residue for generation at least part of its energy needs, and is already extensively taking advantage of this possibility. How far the use of wood as an energy source can be developed will depend on economic factors [1]. As the technology for manufacturing wood and wood-based materials continues to develop, the tendency is for a reduction of wood residue in manufacturing operations, which will ultimately affect the availability of such residue in the factories.

The world production of industrial roundwood is of the same order of magnitude (by weight) as the production of steel and iron. Unlike steel, however, wood represents a renewable resource that can be (and is) constantly replenished as it is being used. As long as the rate of removal does not exceed the rate of growth, forests will be a perpetual source of wood and lumber. The composition of the forest with respect to tree species may change, as may the size of trees at the time of harvesting. But under proper management the resource will always be there. Increasing the intensity of management (tree farming) can lead to substantial increases in productivity on a given area of forest land.

2. Characteristic Properties of Wood

As a natural product of biological origin, wood is characterized by a high degree of diversity and variability in its properties. No one knows exactly how many species of trees there are in the world, but estimates run from 30 000 upwards. A large proportion of these are to be found in the tropical regions, which frequently have an incompletely explored flora. The number of commercial timbers is only a small fraction of the total number of tree species. Since most wood properties are related to wood density, the fact that balsa, the lightest commercial species, has a density of about 160 kg/m^3 as compared with 1 280 kg/m^3 for lignum vitae, one of the heaviest illustrates the diversity that can arise from species differences. In addition, considerable variability is found within speccies due to genetic and environmental factors that influence tree growth. Such variability is found not only from one tree to the next, but also within trees, in part due to natural patterns of growth that make wood properties dependent on radial position and height within a stem. This variability must be taken into consideration if wood is to be used properly.

Wood is a highly anisotropic material, that is, its properties depend significantly on the direction in which they are measured. The principal directions in wood are the longitudinal, radial and tangential directions. The longitudinal direction is parallel to the cylindrical axis of the tree stem, and is also referred to as the direction parallel to grain since the majority of the constituent cells of wood are aligned parallel to it. If a tree stem is cut at right angles to its long axis, a series of concentric rings can often be seen on the cross section. These rings are markings produced by annual growth incre-

ments. The radial and tangential directions are those which are normal and tangential, respectively, to the growth rings on the cross section. The radial and tangential directions are also referred to collectively as directions perpendicular to grain. The tensile strength and stiffness of wood is highest parallel to grain and very low perpendicular to grain. Conversely, the shrinkage of wood that accompanies loss of moisture is very small parallel to grain and very much higher perpendicular to grain. In each of the properties of tensile strength, young's modulus and shrinkage, the largest and smallest values are in the ratio of about 25∶1. The degree of anisotropy is thus extremely high.

Wood can be a very durable material. The key to durability is proper use and understanding of the factors that destroy wood. Wood is biodegradable, which is essential in nature and can be an advantage when wood in use becomes unserviceable and must be disposed of. The same natural process becomes a severe disadvantage when it occurs as biodeterioration of wood in use. The key to preservation is to create conditions unfavorable to the organisms that cause biodeterioration [2]. Principally decay fungi and termites. In the case of fungi this means keeping wood dry.

Wood is susceptible to damage by fire. In match-stick sizes wood burns readily but it is much more resistant in larger sizes. With suitable construction methods wood can provide a high degree of fire safety in the early stages of a building fire giving time for occupants to egress and the fire to be brought under control. This is possible because wood is poor conductor of heat.

As a hygroscopic material wood will take up or give off moisture depending on the temperature and relative humidity of the surrounding atmosphere. Changes in moisture content below the fiber satura-

tion point, which is the state where the cell walls are saturated with adsorbed water and no free water is present in the cell cavities, have an effect on virtually all properties of wood [3]. Wood also shrinks as it dries, and conversely swells when it is wetted again. The total shrinkage in volume of wood from a freshly felled tree dried in an oven will range from about 6% to 20%, depending on species. About two-thirds of the shrinkage will be in the tangential direction and one-third in the radial direction, the longitudinal shrinkage being almost negligible.

New Words and Phrases

stem [stem] n.	树干
branch [bra:ntʃ] n.	枝条,分枝
root [ru:t] n.	根
shrub [ʃrʌb] n.	灌木
gymnosperm ['dʒimnəspə:m] n.	裸子植物
dicotyledonous ['daikɔti'li:dənəs] n.	双子叶植物
angiosperm ['ændʒiouspə:m] n.	被子植物
secretion [si'kri:ʃən] n.	分泌物,分泌作用
hardwood ['ha:dwud] n.	硬材,阔叶材
softwood ['sɔftwud] n.	软材,针叶材
roundwood [raundwud] n.	圆材,杆柱材
sawlog ['sɔ:lɔg] n.	锯材原木
veneer log [ve'niəlɔg] n.	胶合板材,单板原木
pole [poul] n.	电杆,支柱,杆材
piling ['pailiŋ] n.	桩木
pulpwood ['pʌlpwud] n.	造纸材,纸浆材
charcoal ['tʃa:koul] n.	木炭,活性炭

perpetual [pə'petjuəl] a. 永恒的,重复的
diversity [dai'və:siti] n. 多样性
species ['spi:ʃi:z] n. 树种,物种
genetic [dʒi'netik] a. 创造的,遗传学的
variability [ˌvɛəriə'biliti] n. 可变性,变异的
anisotropic [ænaisou'trɔpik] a. 各向异性的
longitudinal [lɔndʒi'tju:dinəl] a. n. 纵向的,轴向,纵梁
radial ['reidiəl] n. a. 径向(的)
tangential [tæn'dʒenʃəl] a. 弦向的,切线的
cross section 横切面
increment ['inkrimənt] n. 生长量,增量
perpendicular [pə:pən'dikjulə] n. a. 垂直(的),正交(的)
tensile strength 抗拉强度
grain [gein] n. 纹理
stiffness ['stifnis] n. 刚度,坚硬性
shrinkage ['ʃriŋkidʒ] n. 收缩,干缩
Young's modulus 杨氏弹性模量
durability [ˌdjuərə'biliti] n. 耐久性,耐候性
biodegradable [ˌbaioudi'greidəbl] a. 生物降解的
biodeterioration [ˌbaiditiəriə'reiʃən] n. 生物腐蚀
preservation [prezə'veiʃən] n. 保存,防腐
concentric [kɔn'sentrik] n. a. 同心(的)
unserviceable [ʌn'sə:visəbl] a. 不能使用的,不耐用的
decay fungi ['fʌŋgai] n. 腐朽菌
termite ['tə:mait] n. 白蚁
hygroscopic [haigrə'skɔpik] a. 吸湿的
fiber saturation point(FSP) 纤维饱和点
cell wall 细胞壁
replenish [ri'pleniʃ] vt. (再)补充,加强

flora ['flɔ:rə][复](floras or florae) n.	植物群(区系)
balsa=(balsa wood) n.	轻木
lignum-vitae n.	愈疮木
egress ['i:gres] n.	出口,发源地
virtually ['və:tjuəli] ad.	实质上,事实上
be classified as	分类为…
associate with	与…联系起来
take advantage of	利用
with respect to	关于,就…而论
arise from	由…而产生,起因于
in nature	实际上,性质上
key to	…的关键
in the case of	关于,就…来说
dispose of	除去,处理

Notes to the Text

1. The forest products industry is in a unique position to use its own wood residue for generation at least part of its energy needs, and is already extensively taking advantage of this possibility. How far the use of wood as an energy source can be developed will depend on economic factors.

句中的动词不定式短语(to use)在句中作目的状语;由连接副词 How 引导一个主语从句。全句可译为:

利用木材剩余物本身,可作所需能源的一部分,这是林产工业的一大特点,而且正广泛地发挥这种优势。木材作为能源能够发展到何种程度,取决于经济因素。

2. The key to preservation is to create conditions unfavorable to the organisms that cause biodeterioration.

动词不定式短语(to creat),在句中作表语;由 that 引导的定语从句修饰 organisms。全句可译为:

保存木材的关键,是创造一种不利于生物降解的有机体(主要是木腐菌和白蚁)生存的条件。

3. Changes in moisture content below the fiber saturation point, which is the state where the cell walls are saturated with absorbed water and no free water is present in the cell cavities, have an effect on virtually all properties of wood.

由 which 引导的非限制性定语从句,用于说明先行词组 the fiber saturation point;而由关系副词 where 引导的定语从句,则是修饰 state。全句可译为:

细胞壁充满着吸附水而细胞腔中没有自由水的状态称为纤维饱和点。含水率在纤维饱和点以下变化,事实上对木材的所有性质都有影响。

Lesson Two

Text

Machining Processes of Wood

Wood machining is the process of manufacturing wood products such as lumber, veneer and furniture parts. The objective of wood machining is to produce a desired shape and dimension with requisite accuracy and surface quality in the most economical way. Machining processes in the manufacture of wood products may be classified as follows: sawing, peeling and slicing, planing, molding and shaping, turning and boring, sanding and nontraditional machining processes such as cutting with laser beams, high-velocity liquid jets and vibrating cutters.

Optimization of wood machining processes involves attempts to reduce losses of machined material and wear of cutting tools, improve the accuracy of dimensions and surface quality, increase production output and reduce cost, and improve worker safety. A major development has been the increased application of microprocesor and computer control systems.

1. Sawing Technology

Sawing is the most important and most frequent cutting process. Sawing machines are classified according to the basic machine design, that is, sash gang saws (reciprocating, miltiple balde frame saws), circular saws, band saws and chain saws. Saws are designat-

ed ripsaws if they are designed to cut along the grain, as bucking or trim saws if they are designed to cut across the grain, or as combination saws if designed to cut along and across the grain, as well as at a certain angle to the grain (e.g. miter saws). Sawing machines are further classified according to their use. Fro example, a bucking saw is used for cutting logs to length, a head rig or head saw for primary log breakdown, a resaw for resawing cants into boards, and edger for edging boards, a trimmer for cutting boards to length, and a scroll saw for general-purpose sawing in furninture plants.

Saw blades are made from cold-rolled, hardened and tempered steel. A high carbon content, nickelalloyed saw steel is used in most cases (e.g. Uddelholm Steel UHB15 N20, 0.75% C and 2.0% Ni) other saw stell alloys may contain manganese, chromium and vanadium. Circular saws typically range from 1.0 to 5.0 mm in thickness and from 100 to 1 800 mm in diameter. The thickness of band-saw and gang-saw blades may range from 0.40 to 2.1 mm.

Band-saw width ranges from 6 to 50 mm for the narrow band saws used in furniture manufacturing, and from 60 to 360 mm for saws used in lumber manufacturing. Band-saw thickness and width depend on the saw wheel diameter and width. As a rule, the saw blade thickness should not exceed 0.1% of the wheel diameter, and the band-saw width should not be greater than wheel width plus gullet depth and an additional 5 mm. The typical gang saws are 2.00 mm in thickness and approximately 175 mm in width.

Saws vary considerably with regard to tooth and gullet design. The primary design considerations include tooth strength and gullet loading capacity, the function of the gullet being sawdust removal. Other important factors are tooth wear and noise generation. The typical band-saw tooth geometry is described by specifying rake and

clearance angle as depicted in Figure 1. If the saw tooth has a face and (or) top bevel, those angles should be also specified. The optimum tooth geometry, as determined from the measurement of power requirements, depends mainly upon cutting direction, wood density and moisture content. Tooth geometry may vary considerably: the rake angle for crosscut circular saws ranges from $+10°$ to $-30°$. In the case of circular ripsaws and band saws, the rake angle will vary from 10° for high-density hardwoods to 30° for softwood species. The clearance angle may range from 8° for dense hardwoods to approximately 10° for softwoods.

The side clearance or set, which is required to reduce friction between the saw blade and generated surface, is usually provided by setting, that is, either by deflecting alternate teeth (spring-setting), or by spreading the cutting edge (swage-setting), as in band saws (Figure 1). The side clearance for wide band saws may range from 0.30 to 0.35 mm for hardwoods and from 0.50 to 0.60 mm for softwoods. Certain specialty circular saws such as smooth-trimmer of miter saws are tapered to provide side clearance. Inserted tooth saws, carbide-or stellite-tipped saws and chainsaw teeth are designed so that a desired side clearance can be provided, and consequently the setting is not required. The purpose of tipping saw teeth with hard alloys is to increase their wear resistance, which prolongs the useful life of the blade [1]. Methods of improving wear resistance of saw teeth have been described in detail by Kirbach(1979).

The actual size of the gullet is determied by the pitch or tooth spacing and the size of the gullet controls the maximum cutting height and feed space. For a typical wide band saw the gullet area is approximately equal to the product of the pitch and the depth divided by 1.75.