高等学校试用教材

建筑类专业英语

暖通与燃气 （第二册）

English in Architecture and Construction

向 阳 主编

中国建筑工业出版社

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本书按国家教委颁布的《大学英语专业阅读阶段教学基本要求》规定组织编写的专业英语教材。本册包括通风、供热、燃气工程、锅炉设备、制冷工程、热工仪表等概述性的内容及新技术的发展概况。全书安排16个单元，每单元除正课文外，还有两篇阅读材料，均配有必要的注释。正课文还配有词汇表和练习，书后附有总词汇表、参考译文和练习答案，语言难度大于第一册，还对科技英语翻译技巧作了简要说明，并增加例句和翻译练习题。本书可供本专业学生三年级下学期使用，也可作有关专业人员自学英语之用。

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前 言

经过几十年的探索，外语教学界许多人认为，工科院校外语教学的主要目的，应该是："使学生能够利用外语这个工具，通过阅读去获取国外的与本专业有关的科技信息。"这既是我们建设有中国特色的社会主义的客观需要，也是在当前条件下工科院校外语教学可能完成的最高目标。事实上，教学大纲规定要使学生具有"较强"的阅读能力，而对其他方面的能力只有"一般"要求，就是这个意思。

大学本科的一、二年级，为外语教学的基础阶段。就英语来说，这个阶段要求掌握的词汇量为2400个（去掉遗忘，平均每个课时10个单词）。加上中学阶段已经学会的1600个单词，基础阶段结束时应掌握的词汇量为4000个。仅仅掌握4000个单词，能否看懂专业英文书刊呢？还不能。据统计，掌握4000个单词，阅读一般的英文科技文献，生词量仍将有6%左右，即平均每百词有六个生词，还不能自由阅读。国外的外语教学专家认为，生词量在3%以下，才能不借助词典，自由阅读。此时可以通过上下文的联系，把不认识的生词猜出来。那么，怎么样才能把6%的生词量降低到3%以下呢？自然，需要让学生增加一部分词汇积累。问题是，要增加多少单词？要增加哪一些单词？统计资料表明，在每一个专业的科技文献中，本专业最常用的科技术语大约只有几百个，而且它们在文献中重复出现的频率很高。因此，在已经掌握4000单词的基础上，在专业阅读阶段中，有针对性地通过大量阅读，扩充大约1000个与本专业密切有关的科技词汇，便可以逐步达到自由阅读本专业科技文献的目的。

早在八十年代中期，建设部系统院校外语教学研究会就组织编写了一套《土木建筑系列英语》，分八个专业，共12册。每个专业可选读其中的三、四册。那套教材在有关院校相应的专业使用多年，学生和任课教师反映良好。但是，根据当时的情况，那套教材定的起点较低（1000词起点），已不适合今天学生的情况。为此，在得到建设部人事教育劳动司的大力支持，并征得五个相关专业指导委员会同意之后，由建设部系统十几所院校一百余名外语教师和专业课教师按照统一的编写规划和要求，编写了这一套《建筑类专业英语》教材。

《建筑类专业英语》是根据国家教委颁发的《大学英语专业阅读阶段教学基本要求》编写的专业阅读教材，按照建筑类院校共同设置的五个较大的专业类别对口编写。五个专业类别为：建筑学与城市规划；建筑工程（即工业与民用建筑）；给水排水与环境保护；暖通、空调与燃气；建筑管理与财务会计。每个专业类别分别编写三册专业英语阅读教材，供该专业类别的学生在修完基础阶段英语后，在第五至第七学期专业阅读阶段使用，每学期一册。

上述五种专业英语教材语言规范，题材广泛，覆盖相关专业各自的主要内容：包括专业基础课，专业主干课及主要专业选修课，语言材料的难易度切合学生的实际水平；词汇

以大学英语“通用词汇表”的4000个单词为起点，每个专业类别的三册书将增加1000～1200个阅读本专业必需掌握的词汇。本教材重视语言技能训练，突出对阅读、翻译和写作能力的培养，以求达到《大学英语专业阅读阶段教学基本要求》所提出的教学目标：“通过指导学生阅读有关专业的英语书刊和文献，使他们进一步提高阅读和翻译科技资料的能力，并能以英语为工具获取专业所需的信息。”

《建筑类专业英语》每册16个单元，每个单元一篇正课文（TEXT），两篇副课文（Reading Material A&B），每个单元平均2000个词，三册48个单元，总共约有十万个词，相当于原版书三百多页。要培养较强的阅读能力，读十万词的文献，是起码的要求。如果专业课教师在第六和第七学期，在学生通过学习本教材已经掌握了数百个专业科技词汇的基础上，配合专业课程的学习，再指定学生看一部分相应的专业英语科技文献，那将会既促进专业课的学习，又提高英语阅读能力，实为两得之举。

本教材不仅适用于在校学生，对于有志提高专业英语阅读能力的建筑行业广大在职工程技术人员，也是一套适用的自学教材。

建设部人事教育劳动司高教处和中国建设教育协会对这套教材的编写自始至终给予关注和支持；中国建筑工业出版社第五编辑室密切配合，参与从制定编写方案到审稿各个阶段的重要会议，给了我们很多帮助；在编写过程中，各参编学校相关专业的许多专家、教授对材料的选取、译文的审定都提出了许多宝贵意见，谨此致谢。

《建筑类专业英语》 是我们编写对口专业阅读教材的又一次尝试，由于编写者水平及经验有限，教材中不妥之处在所难免，敬请广大读者批评指正。

《建筑类专业英语》
编审委员会

Contents

UNIT ONE

Text New Areas of Gas Consumption

[1] New technologies introduce the possibility of whole new areas of gas consumption. In the history of gas industry, technical change has from time to time led to important shifts inthe main sectors of consumption-the most obvious of which have been the changes in the principal uses of gas from lighting to cooking and from cooking to heating. Over a 25 year period, such as the one covered in this study, it is possible that some new use of natural gas, based on a novel technical development, could have an appreciable impact on the demand for gas. ①It is difficult or impossible to predict with any degree of certainty how changing economic, technical and social needs might evolve to create new areas of demand. ②It is possible, however, to identify areas of current research and technical interest which may offer some potential for the future.

[2] Four technologies may be of primary interest over the next twenty five years-fuel cells, combined cycle power generation, compressed natural gas (CNG) as a vehicle fuel and gas-to-gasoline or gas-to-middle distillates conversion processes. Fuel cells and combined cycle power generation offer efficient and environmentally attractive means of producing electricity. CNG and gas-to-synthesis fuels conversion processes may offer natural gas a significant niche in the transportation sector energy demand in some countries.

[3] Fuel cell technology is, in the mid 1980s, still at the research and demonstration stage. In simple terms, a fuel cell can use natural gas as a feedstock to generate electricity (without burning the gas) by a sort of electrolysis-in-reverse; the hydrogen in natural gas is electrochemically combined with oxygen to yield electricity and usable heat. The advantages of fuel cells include an ability to run up and down to follow load requirements, cleanliness, and energy efficiencies of about 50% (compared with about 40% for state-of-the-art conventional power generating) Research work is continuing in Germany, Japan and the United States, and performance is considered by some major engineering manufacturers to be sufficiently reliable to warrant engineering development for utility sized cells. Small-scale, on-site use of fuel cells by industrial or commercial users is considered the most likely path for development.

[4] Combined cycle power generation using natural gas is at a much more advanced stage of development and commercialisation. A gas-driven turbine can be combined with a steam-driven turbine using heat recovered from the flue gases to give conversion efficiency gains in the generation of electricity. This may prove economically attractive to quite a wide range of users. In the United States, gas in combined cycle use has become an attractive fuel for industrial co-generation; the economics depend partly on relative gas and electricity prices to industry, but also on the level of prices paid for surplus power delivered to

the public grid by co-generating plant. As with all new technologies, it is difficult to quantify how widely combined cycle will spread and to what extent, if at all, it may cause gas to displace other fuels in the power generation sector. ③

[5] Compressed natural gas as a vehicle fuel is not a new technology—it was established in Italy in the 1930s and CNG vehicles are in operation in Italy and New Zealand as well as in experimental fleets in the Netherlands, Canada and the United States. Worldwide there are between 300,000 and 400,000 natural gas vehicles powered by CNG. The economic attractiveness of CNG as a vehicle fuel is mainly dependent on relative fuel prices and fuel taxation policies and it is these rather than technical innovations which will probably determine the ultimate size of the market. Substantial growth is not anticipated under existing taxation policies and with the fuel price assumptions used in this study.

[6] Production of synthetic liquid fuels (gasoline, kerosene or gas oil) from natural gas is now technically feasible under processes patented by two major multinational oil companies. There are no short term prospects for further commercialisation of these technologies in the OECD world, but there is a proposal for a gas-to-gas oil conversion project in Malaysia. ④In general, these technologies are likely to be of most interest as a means of obtaining value from remote gas reserves which may otherwise lie dormant. ⑤They may be even more attractive where the foreign exchange component of petroleum-based fuels is high. In most OECD countries, with the clear exception of New Zealand, the relative proximity of well developed or potential markets to gas reserves means that alternative outlets are readily available for gas. This may limit the potential for projects based on these technologies in the OECD area. They may represent an interesting opportunity for both resource development and technology transfer, however, in the developing world.

New Words and Expressions

sector ['sektə]	*n.*	部门
appreciable ['əpriʃiəbl]	*a.*	明显的，可观的
distillate * ['distilit]	*n.*	蒸馏液
synthesis * ['sinθisis]	*n.*	合成
niche [nitʃ]	*n.*	地位，作用
demonstration [ˌdemənsˈtreiʃən]	*n.*	示范，演示
in simple terms	*n.*	简单地说
feedstock * ['fiːdstɔk]	*n.*	原料
electrolysis-in-reverse	*n.*	逆向电解
electrochemically * [iˌlektrəuˈkemikəli]	*ad.*	用电化学方法
state-of-the-art	*a.*	现代水平的
warrant ['wɔrənt]	*vt.*	保证
on-site	*a.*	现场的，就地的

commercialisation	[kəˈməːʃəlizeiʃən]	*n.*	商业化
turbine *	[ˈtəːbin]	*n.*	涡轮机
flue gas	[fluː]	*n.*	排烟气
surplus	[ˈsəːpləs]	*a.*	过剩的
public grid	[grid]	*n.*	电网
quantify *	[ˈkwɔntifai]	*vt.*	确定数量，量化
displace	[disˈpleis]	*vt.*	顶替，取代
fleet	[fliːt]	*n.*	汽车队
in operation			起作用，运转
taxation	[tækˈseiʃən]	*n.*	税收
innovation	[ˌinəuˈveiʃən]	*n.*	革新
assumption *	[əˈsʌmpʃən]	*n.*	假定，设想
kerosene	[ˈkerəsiːn]	*n.*	煤油
multinational	[ˌmʌltiˈnæʃənl]	*a.*	多国的，跨国的
gas oil		*n.*	粗柴油
patent	[ˈpeitənt]	*v.*	获专利权
dormant	[ˈdɔːmənt]	*a.*	没有利用的
proximity *	[prɔkˈsimiti]	*n.*	接近，近似

Notes

①such as the one covered in this study＝such as the period which has been covered in the study of natural gas。

②to predict with any degree of certainty how… with any degree of certainty 作状语插入，引起动词（predict）和它的宾语从句（how 引出）的分离。

③if at all 惯用结构，意为“不管在任何程度上（或范围内）。”

④OECD = Organization for Economic Cooperation and Development 经济合作和发展组织。

⑤which may otherwise lie dormant，otherwise 为副词，意为“不然的话”，修饰谓语 may lie dormant。

Exercises

Reading Comprehension

Ⅰ. Choose the best answer for each of the following.

1. The most obvious of the important shifts in the main sectors of gas consumption may be ＿＿＿＿＿.

A. the change from cooking to lighting

B. the change from heating to cooking

C. the change from lighting to heating

D. the changes from lighting to cooking and from cooking to heating

2. According to the author, it is impossible to ________.

A. identify areas of current research and technical interest

B. have some new use of natural gas which may have an appreciable impact on the demand for gas

C. predict how changing economic, technical and social needs might evolve to create new areas of demand

D. quantify how much combined cycle will spread

3. It is said that fuel cells, combined cycle power generation, compressed natural gas as a vehicle fuel and gas-to-gasoline or gas-to-middle distillates conversion processes ________.

A. were widely used 25 years ago

B. have been successfully employed in the past 25 years

C. may be of primary interest over the next 25 years

D. may be of no use in the future

4. Which of the following is not related to the determination of the ultimate size of CNG market?

A. relative fuel price

B. fuel taxation

C. relative fuel price and fuel taxation

D. technical innovation

5. The technologies of production of synthetic liquid fuels may be more attractive in ________.

A. the areas where the foreign exchange component of petroleum-based fuels is high

B. most OECD countries

C. New Zealand

D. Malaysia

Ⅱ. Are the following statements true or false?

1. Fuel cell has the ability to run up and down to follow load requirements, cleanliness, and energy efficiencies. ( )

2. Combined cycle power generation can not cause gas to displace other fuels in the power generation. ( )

3. Compressed natural gas as a vehicle fuel will have substantial increase under existing taxation policies. ( )

4. Synthetic liquid fuels from natural gas have successfully been produced by two major multinational oil companies. ( )

5. The potential for projects based on these technologies for production of synthetic liquid fuels may be limited if alternative outlets are readily available for gas in the OECD countries. ( )

Vocabulary

Ⅰ. Fill in the blanks with some of the words listed below, changing the form where necessary.

warrant	feedstock	operation	dormant
impact	quantify	patent	displace

1. It is possible to predict that some new use of natural gas will have an appreciable on the demand for gas.
2. Natural gas can be used as a ________ to generate electricity in a fuel cell.
3. Fuel cells are sufficiently reliable to ________ the ability to run up and down to follow load requirement.
4. Although it is difficult to ________ how much combined cycle will spread, gas is believed to displace other fuels in the power generation in future.
5. It is estimated that over 40,000 CNG vehicles are in ________ in the world.

Ⅱ. Complete each of the following statements with one of the four choices given below.

1. A major programme of extension of the nation-wide gas distribution ________ to more remote areas is expected to enable natural gas to increase its share of the residential and commercial sector energy market.
   A. system B. grid C. network D. framework
2. The major use of natural gas is as a feedstock to city gas works, ________ as a directly piped fuel as in other parts of the world.
   A. would rather B. rather than C. as well D. just the same
3. The possibility of new areas of gas consumption is introduced by some ________ tech- nologies.
   A. state-of-the-art B. good-for-nothing
   C. out-of-date D. non-self-governing
4. Remote gas reserves will probably lie ________ until these new technologies are used to produce fuel cells and CNG.
   A. operative B. active C. dormant D. useful
5. ________ can be used to generate electricity without burning the gas in a fuel cell.
   A. Electrolysis B. Electrolyzer
   C. Electromoter D. Electrolysis-in-reverse

Translation **词义选择**

英语词汇有一词多类和一词多义的现象，因而在翻译时要正确选择词义。通常选择词义要根据 1）词在句中的词类；2）词与上、下文的联系；3）词的搭配习惯。

例 1. 1) Structures built on strong rock generally need no foundation since rock is usually as strong as <u>concrete</u>.
由于岩石通常象<u>混凝土</u>一样坚固，因此建造在坚硬岩石上的结构一般不需要基础。

2) A continuous foundation is cheap to dig and to <u>concrete</u>.
连续基础的土方开挖和<u>混凝土浇灌</u>费用低廉。

例 2. 1) <u>Power</u> can be transmitted over a long distance.
<u>电</u>可远距离输送。

2) Friction causes a loss of <u>power</u> in every machine.
摩擦引起机器<u>功率</u>的损耗。

例 3. 1) The gas industry <u>is broken down</u> into several areas. （习惯搭配）燃气工业<u>分为</u>若干部门。

2) The experiment is <u>at once</u> interesting <u>and</u> instructive. （惯用法）
该实验<u>既</u>有趣<u>又</u>有教益。

Directions:

Ⅰ. Translate the following sentences into Chinese, paying attention to the underlined words.

1. The fuel for the lamps was animal fat.
2. The amount of work is equal to the product of the force by the distance.
3. Structures that fit in with nature are more popular.
4. Civil engineers can not be excused from the oral examination.
5. I shall be only too pleased to do my best in that line of work.

Ⅱ. Give the Chinese equivalents to the following technical terms.

1. heat delivery surface
2. mass concrete heat rise 3. water-proof membrane
4. water-cement ratio strength law
5. air-exhaust ventilator
6. ventilation conditioner
7. vent condenser
8. vented gas heater
9. approximate treatment
10. waste-water treatment

Reading Material A

Liquefied Petroleum Gas (LPG)

The mixture of C3 and C4 hydrocarbons which are extracted from "wet" natural gases (and alsoobtained from crude oil refining operations) are mainly composed of propane (C_3H_8) with somepropylene (C_3H_6); and butane (C_4H_{10}) with some butylene (C_4H_8). Small proportions of ethane, ethylene, iso-butane and iso-pentane may also occur in the mixture, and an odorant is usually added for safety reasons. The term " LPG" is a rather unsatisfactory general description of a variable product, whose overall properties, however, are usually determined by appropriate national standards specifications.

Commercial liquefied "butane" has a boiling point of-0. 5℃, a calorific value of 3, 390 btu/cf(after vaporisation)and a gaseous volume of about 240 times its liquid form. It isusually distributed for large-scale applications (e. g. factory heating and direct-firing industrial operations) in the form of a vaporised butane/air mixture, the composition of the mixture being selected so as to depress the dewpoint to an acceptable level①. Suitablemixtures have frequently been used(particularly where LNG is not yet available)in "peak-shaving" operations, to provide additional gaseous fuel at peak periods where the local supply of natural gas is inadequate to meet demand, or as a source of SNG in rural areas.

Commercial liquefied "propane" has a boiling point of 42. 1℃, a calorific value of 2, 563 btu/cf, and a higher degree of volatility than "butane", with 275 times its liquid volume in the gaseous state. Because of its relatively low boiling-point, propane does not normally require external vaporizers. It is commonly used for special applications-e. g. the production of protective atmospheres in metal treatment operations, or in the glass industry, propane-air SNG plants are used to supplement natural gas supplies at times of high demand or during conversion operations. ② In the United States, there are currently nearly 500 such plants, witha combined deliverability of over 5 Bcf/d, which are used for peak-shaving operations. The properties of commercial LPG mixtures vary according to the proportions of the differentcomponents present. LPG in cylinders forms a convenient and highly portable source of heat and light for domestic and commercial applications, particularly where supplies of piped gas are not available. LPG is also widely used in industry wherever a consistent, sulphur-free, non-toxic fuel gas is of special value, as in food manufacturing and poultry breeding.

Its use as an automobile engine fuel has developed more recently, particularly for heavy lorries, public vehicles and urban bus and taxi services.

Existing automotive equipment designed for fuels other than LPG can be converted to operate success fully using the battery. In addition to conversion however, there are on the market engines designed specifically to operate on LPG, particularly smaller engines suitable for indoor use, where their clean exhaust makes it possible to use an internal combustion engine without excessive ventilation. Instances which come to mind are lift trucks for warehouses or ship-hold use, cement mixers. Coal and iron-ore mining equipment and other forms of indoor or underground transport and mechanical power generation. Similarly, certain agricultural tractors and other forming machinery have been designed from the start to operate on LPG.

Notes

①通常将液态丁烷以蒸气丁烷一空气混合气的形式输配给大型用户，混合气组分的选择要使露点减低到容许程度。

②It is commonly used…in metal freatment operations，丙烷-空气代用天然气装置在高需用量或转换运行期间用于补充天然气供应。

Reading Material B

Coal-related Gases

Combustible gases have traditionally been obtained by heating coal in various types of retortin the absence of air; in fact, the coal-gas industry predated the natural gas industry in mostof the world where both types of fuel have been found. The principal components are methane and hydrogen, with smaller proportions of carbon monoxide, ethylene and nitrogen. The dry distillation of coal takes place at temperatures of around 1,000°to 1,150℃, although in the "low temperature carbonization process" somewhat lower temperatures of 500°-750℃ are used.

It has more recently been appreciated that the gentler and long-sustained heating involved in the formation and maturation of coal beds must have produced enormous volumes of methane and other gases in the geologic past, and that a proportion of these gases is likely to have been trapped in the subsurface. Early biogenic and subsequent geochemical transformation processes were probably involved. First, the bacterial degradation of relatively massive terrestrial vegetable material, growing and decaying in a deltaic environment, formed peats and lignites, with the accompanying evolution of carbon dioxide, nitrogen and small volumes of methane. As the delta floor subsided, a process of "coalification" would have set in as a consequence of the increasing heat and pressure resulting from the growth of sedimentary overburden. ①Peats and lignites would thus gradually have been converted into coals by a reaction.

Further volumes of methane and carbon dioxide would then have been evolved; with increasing depth of burial and a sufficient level of temperature, the coalification process would have continued to produce coals of increasing maturity or "rank". The moisture content of the coals would have become progressively less while the proportions of fixed carbon remaining increased. Thus, brown coals, sub-bituminous coals, bituminous coals and eventually anthracites would have been formed.

During the period of geochemical evolution, it is believed that carbon monoxide and carbon dioxide (with considerable amounts of water) were first evolved; then the main stage of methane evolution began when the proportion of fixed carbon approached 75%, i. e. when a temperature of about 140℃ had been reached, corresponding to a depth of burial of perhaps 3,000m; at this stage, medium volatile bituminous coals would have begun to be formed. At about this time also, some of the maceral components (liptinites and vitrinites) of the coals were probably converted into bituminous, oily liquids, which for the most part were subsequently gasified to CO_2 and CH_4. Thereafter, these gases continued to be evolved, with smaller volumes of carbon monoxide and nitrogen, until the final postmature anthracite stage, with perhaps 95% of fixed carbon, was reached.

Some of the gases generated in these processes were adsorbed on and near the coal so that today methane is commonly exuded from freshly-cut coal faces and also occurs (usually with nitrogen, carbon dioxide and some carbon monoxide) in highpressure pockets and fissures in the coal seams, from which dangerous "blowers" of gas may be released. In some modern mines, sufficient methane can be produced by drilling bore-holes from the surface into coal beds to form a useful local fuel source; while it has been estimated that the volume of potentially usable methane contained in US coalfields may amount to as much as 325 Tcf of gas.

Enormous volumes of coal-derived gas must have been generated in this way during the formation and evolution of the roughly 9 trillion tons of the world's known coal resources, and clearly only a very small proportion of this gas could have been retained in the coal-beds, which are generally too dense and impervious to allow much gas to accumulate within them. No doubt, most of the methane was lost to the atmosphere or dissolved in circulating ground waters and in this way removed.

Notes

①随着三角形底层沉降，由于沉积覆盖层增长而引起热和压力升高的结果而进入“煤化”过程。

②显然，只有一小部分的这种气体可能残留在煤层中，通常煤层很密实和不渗透，可使很多气体积存于其中。

UNIT TWO

Text Reaction Kinetics

[1] Thermodynamic equilibrium constants, K, indicate the extent to which a given reaction will proceed toward the right under given conditions if enough time is allowed for equilibrium to beestablished. A small K implies little conversion to products; a large K indicates large equilibrium conversion. Exothermic reactions have a tendency to spontaneity. Thus carbon in an oxygen bearing atmosphere should be expected to oxidize spontaneously, as, indeed, it does. But the rate of oxidation is normally so slow that we consider it zero at ambient conditions. At higher temperatures the rate of oxidation is increased, and the heat evolved tends to raise the temperature further, thus further increasing the rate of oxidation. Temperature ultimately is stabilized at a value fixed by the rate of heat loss from the oxidizing system and the rateat which oxygen is brought to the carbon for reaction.

[2] Endothermic reactions, on the other hand, proceed at a faster rate, as temperature is raised only if the endothermic heat of reaction is supplied from a source exterior to the reaction. An endothermic reaction cannot, on this account, be considered spontaneous and is incapable of an autothermic reaction of the kind described above. ① A good example is shown in the steam gasification of graphite, in which the reaction is highly endothermic and shows an equilibrium constant so small at room temperature as to make equilibrium conversion of carbon to carbon monoxide essentially zero at this temperature. However, as temperature is increased, the thermodynamic equilibrium constant increases rapidly, but the endothermic heat of reaction remains nearly unchanged. Conversion of carbon to CO is clearly facilitated by an increase in temperature in at least two ways: greater equilibrium-conversion is favored, and the rate of conversion is increased with increasing temperature.

[3] This discussion inevitably leads to the conclusion that the thermodynamic equilibrium constant is related to the kinetics of a given reaction. Furthermore, since we are dealing largely with interactions between gaseous and solid phases, diffusion effects must be taken into consideration. Thus, in the case of carbon burning in an oxygen bearing atmosphere, diffusion of oxygen to the carbon interface must occur before oxidation of carbon can take place. ②In the process of diffusing oxygen from air to such an interface, the tendency is to accumulate nitrogen near the interface on account of the depletion of oxygen from the interfacial gas mixture. Thus the oxygen diffusing to the interface and the product CO or CO_2 diffusing from the interface must find their way through the film of nonreacting and "stagnant" nitrogen molecules. The stationary film offers a resistance to the diffusion of reactants and products which can be reduced by higher relative velocities between gas and solids. ③ In the limit, high relative gas velocity erodes the thickness (hence resistance) of the stagnant film to nearly zero at topographical surfaces, but is unable to affect similar