四川理工学院课程实施大纲

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| **课程名称：专业外语** |
| **授课班级：材化20141，防腐20141** |
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**四川理工学院 制**

**2017年 2月**

**《专业外语》课程实施大纲**

**基本信息**

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| 课程代码：  课程名称：专业外语  课程性质：基础必修  学分：2  总学时：30  学期：2016-2017第2学期  上课时间：按照教务处安排  上课地点：按照教务处安排  答疑时间和方式：课间、平时答疑，电话或网络答疑（随时）  答疑地点：上课教室或第二实验楼3084  授课班级：材化20141，防腐20141  任课教师：曾春燕  学院：材料科学与工程学院  邮箱：chunyanzeng@126.com  联系电话：18708390391 |

**1、教学理念**

作为一名高校教师，在教学中注重“以学生为本”，重视研究性学习、探究性学习和协作性学习等现代教育理念的应用，以自己的“教”，来引导学生的“学”，对教学内容做精心取舍，以更好地培养学生的能力，努力成为学生的良师益友。

在教学方法上，大力提倡“学生参与”，采取分组讨论、案例分析等多样的教学方式，努力调动学生的积极性，培养学习兴趣，激发学习热情，使学生充分地参与到整个学习活动中。本着“教学相长”的理念，对于学生提出的问题与质疑，认真对待，耐心解答。

英语作为交流的工具，是一门应用性很强的学科，只有多听、多说、多读、多练才能真正掌握英语这一门语言。因此，在向学生讲解与本专业有关的专业词汇外，对学生强调以多练作为学习的方法与手段也是必要的。

**2、课程介绍**

专业英语是大学英语教学的一个重要组成部分，它促进了学生从学习英语知识向专业应用英语知识的转变，也为三、四年级的本科生阅读专业领域的英语教科书、参考书及文献资料等奠定良好的基础。专业英语的教学不仅仅要培养学生的专业文献阅读能力，更要侧重学生科技英文写作能力及专业语言的交流能力，它是连接大学英语与双语教学的桥梁。

本课程是高等学校本科材料和防腐类专业的必修课程，是学生在完成了英语基础阶段的学习任务后，需要修读的一门专业主干课。通过本课程的学习，使学生了解科技文献的基本结构和表达习惯，掌握与材料腐蚀相关的重要专业词汇，培养学生熟练阅读专业文献和用英语进行科技论文翻译与写作的基本能力，提高学生的综合素质。

学习本课程后，学生能掌握相当数量的专业词条和知识，了解专业科技英语及其翻译的特点，为进一步阅读本专业相关的英文书籍和文献，并将其译成通俗易懂的中文奠定坚实的基础。此外，还能掌握科技论文常用句式和大量专业词汇，可为专业领域内的英文摘要和论文撰写创造有利的条件。

**3、教师简介**

**3.1 教师的职称、学历**

曾春燕，博士、讲师。

**3.2教育背景**

2009.09~2011.07加拿大多伦多大学联合培养博士研究生

2007.09~2013.06合肥工业大学博士研究生

2003.09~2007.07 合肥工业大学本科

**3.3****研究兴趣（方向）**

无机功能材料的制备、表征与应用研究

**4、****先修课程**

大学英语、无机化学、材料化学、物理化学、材料科学与工程

**5、课程目标**

本课程是材料及防腐专业的一门重要必修课。通过本课程的学习，使学生掌握相当数量的专业词条和知识，了解专业科技英语及其翻译的特点，为进一步阅读本专业相关的英文书籍和文献，并将其译成通俗易懂的中文奠定坚实的基础。此外，学习本课程后，还能掌握科技论文常用句式和大量专业词汇，可为专业领域内的英文摘要和论文撰写创造有利的条件。

**6、课程内容**

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| --- | --- | --- | --- |
|  | 内容 | 要求及重点、难点 | 学时安排 |
| Part 1 专业文献选讲 | Unit 1 Why do Metals Corrode?  Unit 2 Corrosion and Its Forms  Unit 3 Corrosion Control  Unit4 Polarization Curves  Unit 5 Electrochemical Impedance Spectroscopy | 1. 进一步了解科技英语在文体、时态、词汇、句式等方面的特点 2. 提高专业文献阅读能力，长难句分析能力   3. 掌握一些重要的专业英语词汇 | 16学时 |
| Part 2  英文科技论文的结构与写作 | Unit 6 How to Write a Scientific Article  Unit 7 The Structure of an Article  Unit 8 Style and Language  Part Ⅲ Abstract | 掌握科技英语的特点，科技论文的结构以及写作技巧，常用句式等 | 14学时 |

**7、课程实施**

**7.1 Unit 1 Why do Metals Corrode?**

**（1）教学目标**

掌握课后常用专业术语，科技英语翻译标准-确切性；科技英语的翻译做到：明确、通顺、简练；翻译过程应做到深刻理解原文、确切表达译文、校核；了解金属腐蚀的原因和电化学腐蚀及其英文表达。

**（2）教学内容**

Corrosion is the disintegration of metal through an unintentional chemical or electrochemical action, starting at its surface. All metals exhibit a tendency to be oxidized, some more easily than others. A tabulation of the relative strength of this tendency is called the galvanic series. Knowledge of a metal's location in the series is an important piece of information to have in making decisions about its potential usefulness for structural and other applications.

The driving force that causes metals to corrode is a natural consequence of their temporary existence in metallic form. To reach this metallic state from their occurrence in nature in the form of various chemical compounds (ores), it is necessary for them to absorb and store up for later return by corrosion, the energy required to release the metals from their original compounds. The following pictures illustrate the similarity in color between pale green malachite, a common copper ore mineral, and the corrosion products on a brass plate (70% copper) exposed to a humid environment.

The thermodynamic or chemical energy stored in a metal or that is freed by its corrosion varies from metal to metal. It is relatively high for metals such as magnesium, aluminum, and iron, and relatively low for metals such as copper, silverand gold. Thefollowing Table lists a few metals in order of diminishing amounts of energy required to convert them from their oxides to metal. The high reactivity of magnesium and aluminum expressed as energy in Table 1.1 is paralleled by the special efforts that were historically required to transform these metals from their respective ores. The industrial process to produce aluminum metal on a large scale, for example, was only invented at the end of the 19th centuryand objects made of this metal where still considered to be a novelty when the 2.85 kg aluminum cap was set as the last piece of the Washington Monumentin 1884.

A typical cycle is illustrated by iron. The most common iron ore, hematite, is an oxide of iron. The most common product of the corrosion of iron, rust, has a similar chemical composition and color. The energy required to convert iron ore to metallic iron is returned when the iron corrodes to form the original compound. Only the rate of energy change may be different.

The energy difference between metals and their ores can be expressed in electrical terms that are in turn related to heats of formation of the compounds. The difficulty of extracting metals from their ores in terms of the energy required, and the consequent tendency to release this energy by corrosion, is reflected by the relative positions of pure metals in a list, which is discussed later as the electromotive series.

**（3) 教学过程及方法**

1）采用教师示范领读，翻译；学生诵读、翻译、教师点评两种方式；

2）阐明科技英语与日常英语的差异。

3）逐句分析句子结构，重点抓住“主、谓、宾”句子主干进行分析。

**（4) 作业安排**

掌握unit 1课后常用专业术语；

翻译reading material 1第一段全部内容。

**（5) 参考文献**

*Corrosion Basics: An Introduction, 2nd Edition, Pierre R. Roberge, by National Association of Corrosion Engineers, 2006.*

**7.2 Unit 2 Corrosion and Its Forms**

**（1）教学目标**

掌握课后常用专业术语，不同腐蚀类型的英文表达以及科技英语中的省略句，熟悉科技英语中的被动句、条件句、非谓语动词及介词短语。

**（2）教学内容**

**2.1 What is corrosion?**

Corrosion is the gradual destruction of materials (usually metals) by chemical reaction with their environment.

In the most common use of the word, this means electrochemical oxidation of metals in reaction with an oxidant such as oxygen. Rusting, the formation of iron oxidesis a well-known example of electrochemical corrosion. This type of damage typically produces oxide(s) or salt(s) of the original metal. Corrosion can also occur in materials other than metals, such as ceramics or polymers, although in this context, the term degradation is more common. Corrosion degrades the useful properties of materials and structures including strength, appearance and permeability to liquids and gases.(*From Wikipedia*)

**2.2 Forms of corrosion**

It is convenient to classify corrosion by the forms in which it manifests itself, the basis for this classification being the appearance of the corroded metal. Each form can be identified by mere visual observation. In most cases the naked eye is sufficient, but sometimes magnification is helpful or required. Valuable information for the solution of a corrosion problem can often be obtained through careful observation of the corroded test specimens or failed equipment. Examination before cleaning is particularly desirable. Some of the eight forms of corrosion are unique, but all of them are more or less interrelated. The eight forms are:

**(1) Uniform, or general attack**

**(2) Pitting**

**(3) Crevice corrosion**

**(4) Galvanic, or two-metal corrosion**

**(5) Intergranularcorrosion**

**(6) Dealloying, or selective leaching**

**(7) Erosioncorrosion**

**(8) Stresscorrosion**

The mentioned Modules have introduced the general science of corrosion processes. In reality, the principles that govern these scientific concepts are rarely of interest to most people facing corrosion problems. The main questions these people generally ask are:

 How serious is the problem?

 How can it be fixed and how muchwill it cost?

 What caused the problem in the first place?

The present Module will focus on answering the first of these questions and the next Module the last. Corrosion damage can take many shapes and forms that are often related to specific alloy/environment/operation conditions. The several forms of corrosion may be divided into three groups:

1) Those recognizable with the unaided eye

2) Those which are more easily discerned with specific aids (e.g. dye penetrants, magnetic particles, or low-power microscopy)

3) Those which can only be identified definitely by optical or electronic microscopy



Fig. 1.4 Main forms of corrosion attack regrouped by their ease of recognition

Much can be deduced from examination of materials which have failed in service. It is often possible by visual examination to decide which corrosion mechanisms have been at work and what corrective measures are required to solve the problem. Below, the eight forms of corrosion are discussed in terms of their characteristics, mechanisms, and preventive measures.

**(1) Uniform corrosion, or general attack**

Uniform corrosion is characterized by corrosive attack proceeding evenly over the entire surface area, or a large fraction of the total area. General thinning takes place until failure. On the basis of tonnage wastedwaster, this is the most important form of corrosion.

However, uniform corrosion is relatively easily measured and predicted, making disastrous failures relatively rare. In many cases, it is objectionable only from an appearance standpoint. As corrosion occurs uniformly over the entire surface of the metal component, it can be practically controlled by cathodic protection, use of coatings or paints, or simply by specifying a corrosion allowance. In other cases uniform corrosion adds color and appeal to a surface. Two classics in this respect are the patina created by naturally tarnishing copper roofs and the rust hues produced on weathering steels.

The breakdown of protective coating systems on structures often leads to this form of corrosion. Dulling of a bright or polished surface, etching by acid cleaners, or oxidation (discoloration) of steel are examples of surface corrosion. Corrosion resistant alloys and stainless steels can become tarnished or oxidized in corrosive environments. Surface corrosion can indicate a breakdown in the protective coating system, however, and should be examined closely for more advanced attack. If surface corrosion is permitted to continue, the surface may become rough and surface corrosion can lead to more serious types of corrosion.

**(2) Pitting**

Pitting corrosion is a localized form of corrosion by which cavities or "holes" are produced in the material. Pitting is considered to be more dangerous than uniform corrosion damage because itis more difficult to detect, predict and design against.

**Pitting is initiated by:**

1) Localized chemical or mechanical damage to the protective oxide film; water chemistry factors which can cause breakdown of a passive film are acidity, low dissolved oxygen

concentrations (which tend to render a protective oxide film less stable) and high concentrations of chloride (as in seawater)

2) Localized damage to, or poor application of, a protective coating

3) The presence of non-uniformities in the metal structure of thecomponent, e.g. nonmetallic inclusions.

**Mechanism:**

The driving power for pitting corrosion is the depassivation of a small area, which becomes anodic while an unknown but potentially vast area becomes cathodic, leading to very localized galvanic corrosion. The mechanism of pitting corrosion is probably the same as crevice corrosion.The more conventional explanation for pitting corrosion is that it is an autocatalytic process. Metal oxidation results in localized acidity that is maintained by the spatial separation of the cathodic and anodic half-reactions, which creates a potential gradient and electromigration of aggressive anions into the pit.

**(3) Crevice corrosion**

Crevice corrosion is a localized form of corrosion usually associated with a stagnant solution on the micro-environmental level. Such stagnant microenvironments tend to occur in crevices (shielded areas) such as those formed under gaskets, washers, insulation material, fastener heads, surface deposits, disbonded coatings, threads, lap joints and clamps. Crevice corrosion is initiated by changes in local chemistry within the crevice:

1) Depletion of inhibitor in the crevice

2) Depletion of oxygen in the crevice

3) A shift to acid conditions in the crevice

4) Build-up of aggressive ion species (e.g. chloride) in the crevice

As oxygen diffusion into the crevice is restricted, a differential aeration cell tends to be set up between crevice (microenvironment) and the external surface (bulk environment). The cathodic oxygen reduction reaction cannot be sustained in the crevice area, giving it an anodic character in the concentration cell. This anodic imbalance can lead to the creation of highly corrosive micro-environmental conditions in the crevice, conducive to further metal dissolution. This results in the formation of an acidic micro-environment, together with a high chloride ion concentration.

The most common form is oxygen differential cell corrosion. This occurs because moisture has a lower oxygen content when it lies in a crevice than when it lies on a surface. The lower oxygen content in the crevice forms an anode at the metal surface. The metal surface in contact with the portion of the moisture film exposed to air forms a cathode.

**(4) Galvanic, or two-metal corrosion**

Galvanic corrosion (also called ' dissimilar metal corrosion' or wrongly 'electrolysis') refers to corrosion damage induced when two dissimilar materials are coupled in a corrosive electrolyte.

When a galvanic couple forms, one of the metals in the couple becomes the anode and corrodes faster than it would all by itself, while the other becomes the cathode and corrodes slower than it would alone. For galvanic corrosion to occur, three conditions must be present:

1) Electrochemically dissimilar metals must be present

2) These metals must be in electrical contact, and

3) The metals must be exposed to an electrolyte

The relative nobility of a material can be predicted by measuring its corrosion potential. The well-known galvanic series lists the relative nobility of certain materials in sea water. A small anode/cathode area ratio is highly undesirable. In this case, the galvanic current is concentrated onto a small anodic area. Rapid thickness loss of the dissolving anode tends to occur under these conditions. Galvanic corrosion problems should be solved by designing to avoid these problems in the first place.

**(5) Intergranular corrosion**

The microstructure of metals and alloys is made up of grains, separated by grain boundaries. Intergranular corrosion is localized attack along the grain boundaries, or immediately adjacent to grain boundaries, while the bulk of the grains remain largely unaffected. This form of corrosion is usually associated with chemical segregation effects (impuritieshave a tendency to be enriched at grain boundaries) or specific phases precipitated on the grain boundaries. Such precipitation can produce zones of reduced corrosion resistance in the immediate vicinity.

The attack is usually related to the segregation of specific elements or the formation of a compound in the boundary. Corrosion then occurs by preferential attack on the grain-boundary phase, or in a zone adjacent to it that has lost an element necessary for adequate corrosion resistance -thus making the grain boundary zone anodic relative to the remainder of the surface. The attack usually progresses along a narrow path along the grain boundary and, in a severe case of grain-boundary corrosion;entire grains may be dislodged due to complete deterioration of their boundaries. In any case the mechanical properties of the structure will be seriously affected.

A classic example is the sensitization of stainless steels or weld decay. Chromium-rich grain boundary precipitates lead to a local depletion of Cr immediately adjacent to these precipitates, leaving these areas vulnerable to corrosive attack in certain electrolytes. Reheating a welded component during multi-pass welding is a common cause of this problem. In austenitic stainless steels, titanium or niobium can react with carbon to form carbides in the heat affected zone (HAZ) causing a specific type of intergranular corrosion known as knife-line attack. These carbides build up next to the weld bead where they cannot diffuse due to rapid cooling of the weld metal. The problem of knife-line attack can be corrected by reheating the welded metal to allow diffusion to occur.

Many aluminum base alloys are susceptible to intergranular corrosion on account of either phases anodic to aluminum being present along grain boundaries or due to depleted zones of copper adjacent to grain boundaries in copper-containing alloys.Alloys that have been extruded or otherwise worked heavily, with a microstructure of elongated, flattened grains, are particularly prone to this damage.

**(6)Dealloying, or selective leaching.**

Dealloying or selective leaching refers to the selective removal of one element from an alloy by corrosion processes. A common example is the dezincification of unstabilized brass, whereby a weakened, porous copper structure is produced.

The selective removal of zinc can proceed in a uniform manner or on a localized (plug-type) scale. It is difficult to rationalize dezincification in terms of preferential Zn dissolution out of the brass lattice structure. Rather,it is believed that brass dissolves with Zn remaining in solution and Cu replating out of the solution. Graphitic corrosion of gray cast iron, whereby a brittle graphite skeleton remains following preferential iron dissolution is a further example of selective leaching. The term "graphitization" is commonly used to identify this form of corrosion but is not recommended because of its use in metallurgy for the decomposition of carbide to graphite.

During cast iron graphitic corrosion the porous graphite network, that makes up 4-5% of the total mass of the alloy, is impregnated with insoluble corrosion products. As a result, the cast iron retains its appearance and shape but is weaker structurally. Testing and identification of graphitic corrosion is accomplished by scraping through the surface with a knife to reveal the crumbling of the iron beneath. Where extensive graphitic corrosion occurs, usually the only solution is replacement of the damaged element.

**(7) Erosion corrosion**

Erosion corrosion is an acceleration in the rate of corrosion attack in metal due to the relative motion of a corrosive fluid anda metal surface. The increased turbulence caused by pitting on the internal surfaces of a tube can result in rapidly increasing erosion rates and eventuallya leak. Erosion corrosion can also be aggravated by faulty workmanship. For example,burrs left at cut tube ends can upset smooth water flow, cause localized turbulence and high flow velocities, resulting in erosion corrosion. A combination of erosion andcorrosion can lead to extremely high pitting rates.

Erosion-corrosion is most prevalent in soft alloys (i.e. copper, aluminum and lead alloys). Alloys which form a surface film in a corrosive environment commonly show a limiting velocity above which corrosion rapidly accelerates. With the exception of cavitation, flow induced corrosion problems are generally termed erosion-corrosion, encompassing flow enhanced dissolution and impingement attack. The fluid can be aqueous or gaseous, single or multiphase.

**(8) Stress corrosion**

Stress-corrosion cracking refers to cracking caused by the simultaneous presence of tensile stress and a specific corrosive medium. Many investigators have classified all cracking failures occurring in corrosive mediums as stress-corrosion cracking, including failures due to hydrogen embrittlement. However, these two types of cracking failures respond differently to environmental variables. To illustrate, cathodic protection is an effective method for preventing stress-corrosion cracking whereas it rapidly accelerates hydrogen-embrittlement effects. Hence, the importance of considering stress-corrosion cracking and hydrogen embrittlement as separate phenomena is obvious.

**（3) 教学过程及方法**

1）采用教师示范领读，翻译；学生诵读、翻译、教师点评两种方式；

2）逐句分析句子结构，重点讲解科技英语中的被动句、条件句、非谓语动词及介词短语。

**（4) 作业安排**

掌握unit 2课后常用专业术语；

掌握科技英语中被动句、条件句及介词短语的应用。

**（5) 参考文献**

*Corrosion Basics: An Introduction, 2nd Edition, Pierre R. Roberge, by National Association of Corrosion Engineers, 2006.*

**7.3 Unit3 Corrosion Control**

**（1）教学目标**

掌握课后常用专业术语，科技英语常用句型结构以及科技英语中的省略句；防腐措施的英文表达。

**（2）教学内容**

**3.1Surface treatment**

**(1) Applied coatings**

Plating, painting, and the application of enamel are the most common anti-corrosion treatments. They work by providing a barrier of corrosion-resistant material between the damaging environment and the structural material. Aside from cosmetic and manufacturing issues, there may be tradeoffs in mechanical flexibility versus resistance to abrasion and high temperature. Platings usually fail only in small sections, but if the plating is more noble than the substrate (for example, chromium on steel), a galvanic couple will cause any exposed area to corrode much more rapidly than an unplated surface would. For this reason, it is often wise to plate with active metal such as zinc or cadmium.

Painting either by roller or brush is more desirable for tight spaces; spray would be better for larger coating areas such as steel decks and waterfront applications. Flexible polyurethane coatings, like Durabak-M26 for example, can provide an anti-corrosive seal with a highly durable slip resistant membrane. Painted coatings are relatively easy to apply and have fast drying times although temperature and humidity may cause dry times to vary.

**(2)Reactive coatings**

The environment is controlled (especially in recirculating systems), if corrosion inhibitors can often be added to it. These chemicals form an electrically insulating or chemically impermeable coating on exposed metal surfaces, to suppress electrochemical reactions. Such methods make the system less sensitive to scratches or defects in the coating, since extra inhibitors can be made available wherever metal becomes exposed. Chemicals that inhibit corrosion include some of the salts in hard water (Roman water systems are famous for their mineral deposits), chromates, phosphates, polyaniline, other conducting polymers and a wide range of specially-designed chemicals that resemble surfactants (i.e. long-chain organic molecules with ionic end groups).

**(3)Anodization**

Aluminium alloys often undergo a surface treatment. Electrochemicalconditions in the bath are carefully adjusted so that uniform pores, several nanometers wide, appear in the metal's oxide film. These pores allow the oxide to grow much thicker than passivating conditions would allow. At the end of the treatment, the pores are allowed to seal, forming a harder-than-usual surface layer. If this coating is scratched, normal passivation processes take over to protect the damaged area.

Anodizing is very resilient to weathering and corrosion, so it is commonly used for building facades and other areas where the surface will come into regular contact with the elements. While being resilient, it must be cleaned frequently. If left without cleaning, panel edge staining will naturally occur.

**(4) Biofilm coatings**

A new form of protection has been developed by applying certain species of bacterial films to the surface of metals in highly corrosive environments. This process increases the corrosion resistance substantially. Alternatively, antimicrobial-producing biofilms can be used to inhibit mild steel corrosion from sulfate-reducing bacteria.

**3.2 Cathodic protection**

Cathodic protection (CP) is a technique to control the corrosion of a metal surface by making that surface the cathode of an electrochemical cell. Cathodic protection systems are most commonly used to protect steel, water, and fuel pipelines and tanks; steel pier piles, ships, and offshore oil platforms.

**(1) Sacrificial anode protection**

For effective CP, the potential of the steel surface is polarized (pushed) more negativeuntil the metal surface has a uniform potential. With a uniform potential, the driving force for the corrosion reaction is halted. For galvanic CP systems, the anode material corrodes under the influence of the steel, and eventually it must be replaced. The polarization is caused by the current flow from the anode to the cathode, driven by the difference in electrochemical potential between the anode and the cathode.

**(2) Impressed current cathodic protection**

For larger structures, galvanic anodes cannot economically deliver enough current to provide complete protection. Impressed current cathodic protection (ICCP) systems use anodes connected to a DC power source (such as a cathodic protection rectifier). Anodes for ICCP systems are tubular and solid rod shapes of various specialized materials. These include high silicon cast iron, graphite, mixed metal oxide or platinum coated titanium or niobium coated rod and wires.

**3.3 Anodic protection**

Anodic protection impresses anodic current on the structure to be protected (opposite to the cathodic protection). It is appropriate for metals that exhibit passivity (e.g., stainless steel) and suitably small passive current over a wide range of potentials. It is used in aggressive environments, e.g., solutions of sulfuric acid.

**3.4 Inhibitor**

A corrosion inhibitor is a chemical compound that, when added to a liquid or gas, decreases the corrosion rate of a material, typically a metal or an alloy. The effectiveness of a corrosioninhibitor depends on fluid composition, quantity of water, and flow regime. A common mechanism for inhibiting corrosion involves formation of a coating, often a passivation layer, which prevents access of the corrosive substance to the metal. Permanent treatments such as chrome plating are not generally considered inhibitors, however. Instead corrosion inhibitors are additives to the fluids that surround the metal or related object.

**（3) 教学过程及方法**

1）采用学生诵读、翻译，教师点评的方式；

2）重点分析长难句型的结构。

**（4) 作业安排**

掌握unit 3课后常用专业术语；

翻译reading material 3第三段内容。

**（5) 参考文献**

*Principles and Prevention of Corrosion, 2nd Edition, Denny A. Jones, by Prentice Hall, 1995.*

**7.4 Unit 4 Polarization Curves**

**（1）教学目标**

掌握课后常用专业术语，掌握科技英语用词顺序；科技英语中间单句的直译。**（2）教学内容**

**4.1 Introduction**

One of the most common electrochemical methods in corrosion research and testing is the determination of the polarization curve –the relationship between the current and the potential, usually over a relatively wide range (of the order of a volt). It is normally the objective to determine polarization curves under near steady-state conditions (i.e., the measured current at each potential is essentially that that would be obtained after a long period at a constant potential).For at least two reasons, this is not really possible:

(1) When corrosion reactions are occurring, the electrode will change with time, especially in the anodic region of the curve, and hence there is really no such thing as steady-state.

(2) It is not usually feasible to use morethan a fewsamples, and therefore measurements must bemade at different potentials on the same sample;the prior history of the sample is thus likely toinfluence the behavior.

Thus, the measurement of a polarization curve involvesan element of compromise, and the optimum methodand parameters to use will depend on the system beingstudied. As a general rule, systems exhibiting a lowcorrosion rate benefit fromslowmeasurementmethods(since the electrodes will change only slowly by corrosionand the low currents involved will be more easilyperturbed in the short term by factors such as doublelayercharging currents and currents associated withthickening of passive oxide films), while systems exhibitingrapid corrosion can (and should) be measured more quickly, since the actively corroding surface willreachnear-steady state quickly and will change morequickly as a result of corrosion.

**4.2 Measurement methods**

Polarization curves can be measured either bycontrolling the current and measuring the potentialor by controlling the potential and measuring thecurrent. Since control of current is somewhat easierthan control of potential, early measurements tendedto use controlled current, but it has a number ofdisadvantages; in particular, it is not possible tocontrol the potential in the passive region ofactive-passive polarization curves using controlledcurrent (Fig. 1.11). Thus, modern approaches almostinvariably use controlled potential.The polarization curve is notionally a continuous function, in that the potential can be held at any value and the current measured. In practice, however, there are two approaches to the measurement –the potential can be swept smoothly through the range of values of interest (leading to a potentiodynamic polarization curve) or it can be stepped over a range of reasonably small steps (typically in the range of 10-50mV and leading to a potentiostep curve). The advantage of the potentiodynamic method is that it provides an essentially continuous curve. The advantage of the potentiostepmethod is that the measured current can be taken at the end of the step hold period, and therefore it approaches steady-state a little more closely for the same overall measurement time. It also permits the use of new specimens for each potential, which minimizes effect due to the prior history of the specimen (though it also much more time-consuming and expensive, and introduces questions about sample-to-sample reproducibility).

The potentiodynamic method requires a potentiostat, a linear sweep generator (to produce the potential sweep) and a recording device of some kind to record the current and potential. In principle, the latter can be an X–Y recorder (possibly with a log converter on one axis to record log (current)), or a conventional recorder with a hard-working research student to extract and process the information. However, most modern systems will use a computer data acquisition system to manage the measurement and facilitate the processing of the data. The wide dynamic range of the measured current presents something of a problem here, and it is common for dedicated systems to use automatic range switching in order to permit the measurement of both large and small currents.

The sweep rate is an important parameter, as it controls the closeness with which steady-state is approached. Typical values of sweep rate are of the order of 1 mVs-1; as indicated earlier, a slow sweep rate is required for low corrosion rates, while a faster sweep can be used (and may be necessary to avoidexcessive modification of the working electrode by corrosion) for systems that are corroding rapidly.

**4.3 Interpretation**

The simplest approach to the interpretation of polarizationcurves is to model the curve as the summationof a series of curves corresponding to the individualelectrochemical reactions that can occur. Asactivation-controlled reactions exhibit a linear relationshipbetween potential and log(current density),it is normal to plot potential using linear axes andcurrent density using log axes (strictly the absolutevalue of current density, since log(x) does not existfor x<0). Since the potential is usually the controlledvariable and current density the measuredvariable, polarization curves should strictly be plottedwith potential on the x-axis. However, earlyworkers controlled current and therefore plotted currentdensity on the x-axis, and many workers still usethis convention.

Figure 1.12 (taken from ASTM Standard G5:1998, which provides a standard method for determining polarization curves) shows an example polarization curve, in this case for a ferritic stainless steel in sulfuric acid (the curve displays as a band because this figure shows the range of curves obtained by different labs on a particular batch of steel). The labels on the right of Figure 1.1210indicate what is happening in each region of the curve. Note that there are two passivation reactions; the first corresponds to passivation by Cr2O3, while the second corresponds to passivation by Fe2O3as well as Cr2O3.

An important process in the analysis of polarizationcurves is the estimation of the Tafelslope(the slope of the linear region of the E-log|i|curve). For an ideal activation controlled reaction,this is straightforward (though easy for beginnersto miscalculate the slope, for example by taking log(i1-i2) rather than log (i1)-log (i2)). However, realpolarization curves tend not to show a clear Tafelregion, and it can be impossible to determine theTafel slope. As a guide, a Tafel slope should beconsidered to be reliable only if it meets the followingconditions:

(1) The polarization curve is straight for at least onedecade of current (i.e., the current changes by afactor of ten).

(2) The straight region of the polarization curveshould start at about one Tafel slope away fromthe open circuit potential (i.e., if the Tafel slope is60mV, then the curve should become linear atabout 60mV from the corrosion potential). Thisis not an exact rule, as it depends on the relationshipbetween the anodic and cathodic slopes; if indoubt, a good check is to overlay the calculatedcurve onto the measured curve.

(3) The Tafel slope should not ‘undercut’ the polarizationcurve between the open circuit potentialand the start of the Tafel region. If this occurs,it suggests that the Tafel slope corresponds to adifferent reaction from the one that is dominant atthe open circuit potential; a common student erroris to fit a Tafel slope to the hydrogen evolutionreaction when the dominant reaction at the opencircuit potential is oxygen reduction (Fig.1.13).The Tafel slope may be correct in this situation,but it is not relevant to the corrosion process(therefore, it cannot be used, for example, to computethe Stern-Geary coefficient).

**（3) 教学过程及方法**

1）采用学生诵读、翻译，教师点评的方式；

2）重点分析科技英语用词顺序及科技英语中间单句的直译。

**（4) 作业安排**

掌握unit 4课后常用专业术语；

掌握科技英语中用词的顺序。

**（5) 参考文献**

*Experimental Techniques for Evaluating Corrosion, R. A. Cottis, by Elsevier B.V., 2010*

**7.5 Unit5 Electrochemical Impedance Spectroscopy**

**（1）教学目标**

掌握课后常用专业术语，掌握科技英语中动词、名词、形容词等的词性转换。**（2）教学内容**

**5.1 Introduction**

Electrochemical impedance spectroscopy, EIS, extendsthe polarization resistance method by measuring howthe impedance varies with frequency. There are anumber of ways inwhich this measurement can be made, but in essence the measurement consists in applying a series of ac currents and measuring the ac potential response or applying a series of ac potentials and measuring the current response. The impedance is then calculated by dividing the potential by the current at each frequency (using complex arithmetic in order to maintain the phase information). There are a number of criteria that must be satisfied in order to make a valid measurement, including:

(1) Linearity: the response of the system must be proportional to the perturbation (this is rarely true for electrochemical systems, but we approach it by using small amplitude perturbations).

(2) Causality: the response of the system must be a direct result of the perturbation (power line noise and similar interference would result in a breach of this requirement, as would randomly occurringoccurcurrents associated with localized corrosion).

(3) Stability: this requirement requires that the system does not exhibit characteristics such as multiple values for a given perturbation, or (equivalently) regions of negative resistance (electrochemical systems are often not stable, including any systems that include an active–passive transition).

It is possible to test EIS data for failure to meet these requirements, the most common method being to use the Kramers-Kronig (K–K) transform; this allows for the calculation of the phase response from the amplitude response and vice versa. If the calculated and measured data do not match up, this implies that the data are not valid (note that this is a necessary, but not sufficient, condition –valid data will not fail the K–K transform test, but it is possible for invalid data to pass it).

**5.2 Presentation of EIS data**

The EIS measurement produces a set of amplitude and phase values for a range of frequencies, and there are two main ways of presenting these:

(1) The Bode plot presents log (amplitude) and phase against log (frequency). Figure 1.15presents a Bode plot for the equivalent circuit of Fig.1.14(this is known as the Randles equivalent circuit and has three components: Rs is the resistance of the solution, Rpis the polarization resistance of the metal–solution interface, and Cdlis the double-layer capacitance of the metal-solution interface). On the Bode plot, a resistor produces a horizontal line on the amplitude plot with amplitude equal to the resistance and a constant phase of zero on the phase plot. A capacitor produces an amplitude that falls with a slope of -1 as the frequency increases (the amplitude of the impedance is 1/ (2πfC), where f is the frequency and C the capacitance), and a constant phase of -90º; as we are normally dealing with resistors and capacitors, it is common to invert the phase axis (i.e., plot-phase) so that capacitive circuit elements give data above zero.

(2) The Nyquist plot normally plots the imaginary partof the impedance against the real part (Fig.1.16).The Nyquist plot invariably inverts the imaginaryaxis (i.e., it plots the imaginary component of impedancewith increasingly negative values on the y-axis),so that capacitive circuit elements plot above thex-axis. One weakness of the Nyquist plot comparedwith the Bode plot is that it does not implicitlyinclude the frequency of each measurement point,so at least some points should have their frequencyindicated.

**5.3 Interpretation of EIS measurements**

The interpretation of EIS data is essentially concerned with determining the components inside a sealed ‘black box’ with just two leads connected to the outside. It is relatively easy to determine the values of internal components if we know what their configuration is, but if we do not know the configuration or the number of components there is no unique solution to the problem, as there are an infinite number of circuits that could produce the observed behavior. The simplest example of this is circuits that contain only resistors. Any resistor network will appear from the outside as a pure resistor (i.e., the measured impedance will have constant amplitude and zero phase). Consequently, in order to obtain a valid interpretation, it is important to use prior knowledge of the expected behavior in order to model the real physical system.

There are two basic approaches to model EIS performance, and hence to determine the properties of the elements of the electrochemical interface by adjusting the parameters of the model to match the measured data:

(1) The response of the chemical and electrochemical processes to a fluctuating potential is analyzed with a mathematical or numerical model in order to produce a simulated spectrum, and the parameters of the model are adjusted to fit the measured spectrum. This is technically an ideal approach, as it provides a direct relationship between the physical processes occurring and the observed spectrum, and can include the effects of nonlinearity in response, but it is very demanding of time and skill, and it is therefore used only infrequently.

(2) A much more common approach is for the components of the system under investigation to be modeled by electrical equivalent circuit elements that have similar characteristics to theactual processes concerned. Thus, a paint film can be modeled as a resistor (corresponding to ionic current passing through the film) in parallel with a capacitor (corresponding to the capacitance of the paint film acting as a parallel plate capacitor); underneath the paint filmthe metal–solution interface gives rise to a resistor (corresponding to the charge transfer resistance) in parallel with a capacitance (the double-layercapacitance). The response of the resultant electrical circuit is then modeled using conventional methods from electrical engineering, and the parameter values adjusted to optimize the fit between the model and real data. Note that the equivalent circuit is derived first, based on the physical processes occurring; it may then be necessary to modify the equivalent circuit to fit features of the measured data. It is important that the added elements are linked to a physical process; some less-experienced workers try different equivalent circuits to find the one that best fits the measured data and then try to work out what the elements correspond to; while this may provide a good fit to the data, the circuit may have the wrong configuration so that the values of circuit elements give no information about the real processes occurring.

**（3) 教学过程及方法**

1）采用学生诵读、翻译，教师点评的方式；

2）重点分析科技英语中动词、名词、形容词等的词性转换。

**（4) 作业安排**

掌握unit 5课后常用专业术语；

阅读reading material 5，了解与腐蚀相关的期刊文献。

**（5) 参考文献**

*Experimental Techniques for Evaluating Corrosion, R. A. Cottis, by Elsevier B.V., 2010.*

**7.6 Unit6 How to Write a Scientific Article**

**（1）教学目标**

培养学生科技英语的写作能力;能借助于词典等工具完成汉译英。

**（2）教学内容**

**6.1 Whatis a scientific paper?**

A paper is an organized description of hypotheses, data and conclusions, intended to instruct the reader. Papers are a central part of research. If your research does not generate papers, it might just as well not have been done. “Interesting and unpublished” is equivalent to “non-existent”.

Realize that your objective in research is to formulate and test hypotheses, to draw conclusions from these tests, and to teach these conclusions to others. Your objective is not to “collect data”.

A paper is not just an archival device for storing a completed research program; it isalso a structure for planningyour research in progress. If you clearly understand the purpose and form of a paper, it can be immensely useful to you in organizing and conducting your research. A good outline for the paper is also a good plan for the research program. You should write and rewrite these plans/outlines throughout the course of the research. At the beginning, you will have mostly plan; at the end, mostly outline. The continuous effort to understand, analyze, summarize, and reformulate hypotheses on paper will be immensely more efficient for you than a process in which you collect data and only start to organize them when their collection is “complete”.

**6.2 How should youconstruct an outline?**

The classical approach is to start with a blank piece of paper, and write down, in any order, all important ideas that occur to you concerning the paper. Ask yourself the obvious questions:“why did I do this paper?”; “what does it mean?”; “what hypotheses did I mean to test?”; “what ones did I actually test?”; “what were the results? Did the work yield a new method of compound? What?”; “what measurements did I make?”; “what compounds? How were they characterized?”.,Sketch possible equations, figures, and schemes. It is essential to try to get the major ideas. If you start the research to test one hypothesis, and decide, when you see what you have, that the data really seem to test some other hypothesis better, don’t worry. Write them both down, and pick the best combinations of hypotheses, objectives, anddata. Often the objectives of a paper when it is finished are different from thoseused to justify starting the work. Much of good science is opportunistic and revisionist.

When you have written down what you can, start with another piece of paper and tryto organize the jumble of the first one. Sort all of your ideas into three major heads:

(1) Introduction

Why did I do the work? What were the central motivations and hypotheses?

(2) Results and discussion

What were the results? How were compounds made andcharacterized? What was measured?

(3) Conclusions

What does it all mean? What hypotheses were proved or disproved? What did I learn? Why does it make a difference?

Next, take each of these sections, and organize it on yet finer scale. Concentrate on organizing the data. Construct figures, tables, and schemes to present the data as clearly and compactly as possible. This process can be slow-I may sketch a figure five to ten times in different ways trying to decide how it is most clear (and looks best aesthetically).

Finally, put everything-outline of sections, tables, sketches of figures, equations-in good order.

When you are satisfied that you have included all the data (or that you know what additional data you intend to collet), and have a plausible organization, give the outline to me. Simply indicate where missing data will go, how you think (hypothesize) they will look, and how you will interpret them if your hypothesis is correct. I will take this outline, add my opinions, suggests changes, and returne it to you.Itususally takes four to five iterations (often with additional experiments) to agree on an outline. When we have agreed, the data are usually in (or close to) final form (that is, the tables, figures, etc., in the outline will be the tables, figures, … in the paper)

You can then start writing, with some assurance that much of your prose will be used.

The key to efficient use of your and my time is that we start exchanging outlines and proposals as early in a project as possible. Do not, under any circumstances, wait until the collection of data is “complete” before starting to write an outline.No project is ever complete, and it saves enormous effort and much time to propose a plausible paper and outline as soon as you see the basic structure of a project. Even if we decide to do significant additional work before seriously organizing a paper, the effort of writing an outline will have helped to guide the research.

**（3) 教学过程及方法**

1）采用教师讲授与学生提问相结合的教学方式；

2）重点分析科技论文的结构，写作方法等。

**（4) 作业安排**

阅读reading material 6，写一篇cover letter。

**（5) 参考文献**

*George M. Whitesides, whitesides’ Group: writing a paper, Adv. Mater.,16(2004): 1375-1377.*

**7.7 Unit 7 The Structure of an Article**

**（1）教学目标**

掌握科技论文的几种形式以及常见的论文结构包括哪些部分，以及每部分的写作格式。

**（2）教学内容**

**7.1The structure of an article**

Scientific writing follows a rigid structure. A format developed over hundreds of years and considered to be the most efficient means for communicating scientific findings to the broader research community. Moreover, the format has the advantage that it allows the article to be read at several levels. Some people will refer to just the title, others may read only the title and abstract, while those who want a deeper understanding will read most, if not all, of the article.

Most disciplines use the format of title, authors, abstract, keywords, introduction, methods, results, discussion, acknowledgments, references and supplementary material. Though the headings are standard for most journals, there is some variation, so it is essential to read the guide for authors of the journal you intend to submit your article to prior to writing.

**7.2 Title**

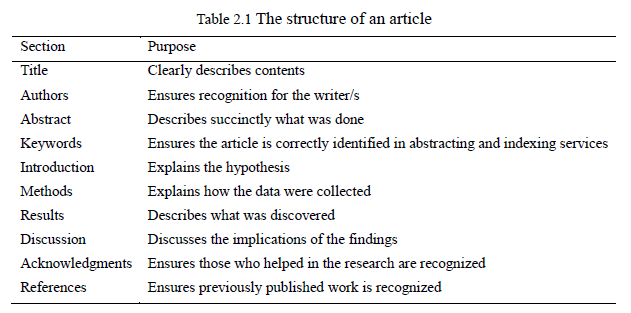
A title should describe the article’s content clearly and precisely, and allow the reader to decide whether it would beappropriate to consult the article further. The title is the advertisement for the article –a poorly titled article may neverreach its target audience, so be specific. Omit unnecessary words such as “A study of”, “Investigations of”, “Observationson”, etc. Do not use abbreviations and jargon. Indexing and abstracting services depend on the accuracy of the title,extracting keywords from it that are used in cross-referencing.

**7.3 Authors**

The listing of authors should only include those who have made an intellectual contribution to the research, who will publicly defend the data and conclusions, and who have approved the final version. The order in which the names of the authors appear can vary from discipline to discipline. In some fields the corresponding author’s name appears first.

**7.4 Abstract**

The abstract should summarize, in 50 to 300 words, the problem, the method, the results, and the conclusions. The titleis the simplest statement about the content of your article. In contrast, the abstract allows you to elaborate on eachmajor section of the article. The abstract should give sufficient detail so that the reader can decide whether or not toread the whole article. Together, the title and the abstract should be able to stand on their own, as they are processedfurther by abstracting services. For this reason it is advisable not to include references to figures or tables, or citationof the reference in the abstract. Many authors write the abstract last so that it accurately reflects the content ofthe article.



**7.5 Keyword list**

Some journals request a keyword list; this list provides the inclusion of important words, in addition to those already present in the title. Appropriate choice of keywords will increase the likelihood of your article being located by other researchers. These words are used by the indexing and abstracting services. Many Elsevier journals will also require authors to choose a subject classification during the online submission process. This classification helps editors to select appropriate reviewers.

**7.6 Introduction**

The introduction should be brief, ideally one to two paragraphs long. It should clearly state the problem beinginvestigated, the background that explains the problem, and the reasons for conducting the research. You shouldsummarize relevant research to provide context, state how your work differs from published work and importantly whatquestions you are answering. Explain what findings of others, if any, you are challenging or extending. Briefly describeyour experiment, hypothesis(es), research question(s), and general experimental design or method. Lengthyinterpretations should be left until the Discussion.

**7.7 Methods**

(Materials and Methods or Experimental Methods, etc.) The key purpose of this section is to provide the reader enoughdetails so they can replicate your research. Explain how you studied the problem, identify the procedures you followed,and order these chronologically where possible. If your methods are new, they will need to be explained in detail;otherwise, name the method and cite the previously published work, unless you have modified the method, in whichcase refer to the original work and include the amendments. Identify the equipment and describe materials used andspecify the source if there is variation in quality of materials. Include the frequency of observations, what types of datawere recorded. Be precise in describing measurements and include errors of measurement. Name any statistical testsused so that your numerical results can be validated. It is advisable to use the past tense, and avoid using the firstperson, though this will vary from journal to journal.

**7.8 Results**

In this section you objectively present your findings, and explain inwords what was found. This is where you show thatyour new results are contributing to the body of scientific knowledge, so it is important to be clear and lay them out ina logical sequence. Raw data are rarely included in a scientific article; instead the data are analyzed and presented in theform of figures (graphs), tables, and/or descriptions of observations. It is important to clearly identify for the reader anysignificant trends. The results section should follow a logical sequence based on the table and figures that best presentsthe findings that answer the question or hypothesis being investigated. Tables and figures are assigned numbersseparately, and should be in the sequence that you refer to them in the text. Figures should have a brief description (alegend), providing the reader sufficient information to know how the data were produced. It is important not tointerpret your results -this should be done in the Discussion section.

**7.9 Discussion**

In this section you describe what your results mean, specifically in the context of what was already known about thesubject of the investigation. You should link back to the introduction by way of the question(s) or hypotheses posed. Youshould indicate how the results relate to expectations and to the literature previously cited, whether they support orcontradict previous theories. Most significantly, the discussion should explain how the research has moved the body ofscientific knowledge forward. It is important not to extend your conclusions beyond what is directly supported by yourresults, so avoid undue speculation. It is advisable to suggest practical applications of your results, and outline whatwould be the next steps in your study.

**7.10 Acknowledgments**

This section should be brief and include the names of individuals who have assisted with your study, including,contributors, reviewers, suppliers who may have provided materials free of charge, etc. Authors should also disclose intheir article any financial or other substantive conflict ofinterest that might be construed to influence the results orinterpretation of their article.

**7.11 References**

Whenever you draw upon previously published work, you must acknowledge the source.Any information not fromyour experiment and not "common knowledge" should be recognized with a citation. How citations are presentedvaries considerably from discipline to discipline and you should refer to the guide for authors for the specific journal.Quotes that appear in the article, if long, should have theirown indented paragraph. Otherwise, if they are in the naturalflow of the article they should be within quotation marks. In both cases they should include a reference.The references section that appears at the end of the article includes all references cited in your article. This section is incontrast to a bibliography, common in books, where works read but not necessarily cited in the text are listed. Themanner in which references are presented also varies from journal to journal and you should consultthe journal’s guidefor authors.

**（3) 教学过程及方法**

1）采用教师讲授与学生提问相结合的教学方式；

2）重点分析科技论文各部分的写作格式和方法，以及常用句式。

**（4) 作业安排**

阅读reading material 7，熟悉科技英语写作常用句式。

**（5) 参考文献**

*A guide to publishing in scholarly journals, Author Pack, Publishedby Elsevier B.V., 2008.*

**7.8 Unit8 Style and Language**

**（1）教学目标**

了解科技论文写作中容易出现的语法错误，以及投稿过程中可能出现的几种状态，以及如何用英文表达。

**（2）教学内容**

**8.1 Style and language**

It is important to refer to the journal’s guide for authors’ notes on style. Some authors write their article with a specific journal in mind, while others write the article and then adapt it to fit the style of a journal they subsequently choose. Regardless of your preference, some fundamentals remain true throughout the process of writing a scientific article. The object is to report your findings and conclusions clearly, and as concisely as possible; try to avoid embellishment with unnecessary words or phrases. The use of the active voice will shorten sentence length. For example, carbon dioxide was consumed by the plant... is in the passive voice. By changing to the active voice it can be shortened to the plant consumed carbon dioxide... The following shows how tenses are most often used in science writing:

(1) For known facts and hypotheses, the present tense should be used.

The average life expectancy of a honey bee is 6 weeks.

(2) When you refer to experiments you have conducted, the past tense should be used.

All the honey bees were maintained in an environment with a consistent temperature of 23 ℃.

(3) When you describe the results of an experiment, the past tense should be used.

The average life span of bees in our contained environment was 8 weeks.

If English is not your first language it is recommended that you ask a native English speaker to review the article before you submit it for publication. Alternatively you could use a language editing agency.

**8.2 Some points of style**

(1) Do not use nouns as adjectives:

Not: ATP formation; reaction product

But: formation of ATP; product of the reaction

(2) The word “this” must always be followed by a noun, so that its reference is explicit.

Not: this is a fast reaction; this leads us to conclude…

But: this reaction is fast; this observation leads us to conclude…

(3) Describeexperimental results uniformly in the past tense.

Not: addition of water gives product.

But: addition of water gave product.

(4) useUsethe active voice whenever possible.

Not: it was observed that the solution turned red.

But: the solution turned red. Or we observed that the solution turned red.

(5) Complete all comparisons.

Not: the yield was higher using bromine.

But: the yield was higher using bromine than chlorine.

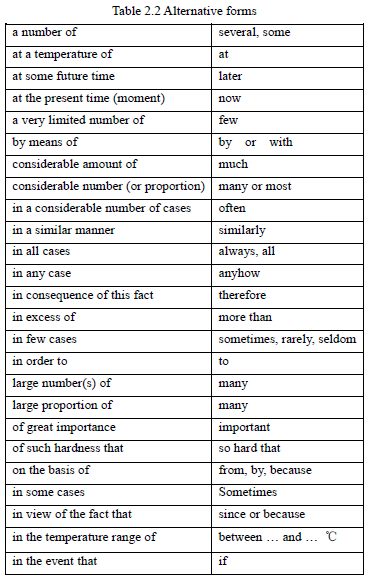
(6) simplicationSimplication

Not: As can be seen from Fig.1, growth is rapid.

But: Growth is rapid (Fig.1). or Fig.1 shows that growth israpid.

Not: As shown in Fig.1 …

But: Fig.1 shows …

下述句式可以更加简捷的形式表达，见Table 2.2

**（3) 教学过程及方法**

1）采用教师讲授与学生提问相结合的教学方式；

2）重点讲解科技论文写作中容易出现的语法错误。

**（4) 作业安排**

阅读reading material 8，熟悉科技论文投稿过程中可能出现的几种状态。

**（5) 参考文献**

*George M. Whitesides, whitesides’ Group: writing a paper, Adv. Mater., 16 (2004): 1375-1377.*

**7.9 Part Ⅲ Abstract**

**（1）教学目标**

了解英文摘要写作的重要性，掌握英文摘要的内容，撰写英文摘要的步骤以及英文摘要写作技巧。

**（2）教学内容**

摘要(abstract，亦称文摘)作为对研究论文正文的精炼概括，非常便于读者在最短的时间内了解全文内容。随着国际检索系统的出现，摘要逐渐成为一种信息高度密集的相对独立文体，为人们在浩如烟海的文献中寻找所需要的信息提供了便利。

目前英文摘要存在的普遍弊病是可读性不强，信息量不够。英文摘要的语言必须符合英语的语法规定和表达习惯。许多出版物都对摘要有特定的要求，出版社通常在“guidelines for authors”中提供详细要求。这里只对通用的英文摘要的写作方法作简单介绍。

**1**．摘要的内容

(1) 研究的目的(objective or purpose)。

(2) 研究的过程与采用的方法(process and methods)。

(3) 主要结果或发现(results)。

(4) 主要结论或推论(conclusion)。

**2**．撰写摘要的基本步骤

摘要写作可按如下顺序写：

第一句：讲一下你这篇文章的研究意义（但是有的杂志不需要这句话）。

第二句：以To elucidate the mechanism..., To investigate...., 或for the purpose of....开头来讲述你这样研究的目的。

第三句：.... was carried out .... with ...treatment. 讲述你研究的内容，研究的方法。

第四句：The resulted showed that ......, 讲述你这样研究得出的主要研究结果。

第五句：The result of the present work implied that... 讲述由你的研究结果得出的结论。

另外，在摘要中不要用到参考文献，如果一定要用的话，那么一定要将全部的细节写出来。要始终记住一点，Abstract 是一个独立的部分，换句话说，别人不看你的文章，只看你的Abstract 就能了解你的研究工作。

**3**．摘要写作技巧

(1) 首句的撰写

读者阅读摘要时主要关注result、conclusion、新的方法或者与自己研究相关的方法，因而，摘要的首句简单陈述研究的subject or object即可。

例如：The present paper reports a study of three cases presenting the pathological aspect of chronic nonevolutive MS，corresponding to a clinical picture of benign MS．

为避免介绍一般性的标题或背景信息。一个简单有效的方法是开始句用“This paper”，“This study”，“This research”；首句也可以很简洁地转入研究主旨。

例如：Hypotheses are developed and tested about the characteristics of organizations and their environments that favor the proliferation of detailed job titles to describe work roles．

由于摘要常紧接标题，若标题已清晰表达出研究的目的，则首句不要重复或解释标题的内容。此时摘要可以直接从方法部分开始写。

摘要的首句若为其他文献作者报道、讨论或综述的内容，则用过去时或现在完成时；表达着手研究时所确定的目的即研究目的时一般用过去时；表达文本的目的即叙述的目的时用一般现在时。

(2) 方法与结论结果部分的撰写

研究的过程与方法这部分内容依赖于论文的创新性和重要性，重点是介绍新的重要材料与方法：新化合物、新设备、新分析方法等。若所用的方法是学科中标准的、众所周知的、或方法的名称可查到的，在摘要中就可以省略这部分内容，直接由目的部分转到结果部分。结果是研究同行最关注的部分，因而结果部分是摘要的主要部分。

若研究是由一系列实验组成，所得结果则尽可能都合并起来共同给出，因为分别给出显得比较重复，也比较浪费版面。

如果研究的焦点是新方法或新技术，则摘要的大部分应该用于对方法进行详尽描述，结果可以写得简单些，只占摘要的一小部分。

若研究所用的方法比较复杂，也可以用比较长的篇幅进行详细叙述。

摘要常常与题目在一起，若论文的主题在题目中已清楚说明，则在摘要中就不要再重复，此时摘要就可以直接从描述研究的方法开始。

方法和结果部分不能写注释或讨论的内容。在论文中常常将数据简化为图表形式，许多结果均是用图、表及其他形式表达的，但是此方法不适用于摘要；在一般情况下，大多数的数学推理和数学证明不宜放入摘要，应该省略。

(3) 讨论和结论部分的撰写

虽然讨论(discussion)部分在论文的正文中很重要，但是在摘要中只需要结论(results)部分，却不需要讨论。这是因为研究者肯定会在其后续的相关工作中借鉴使用其中所报道的方法和结果，但是对结果所做的解释(即讨论部分)受一些因素的影响，随着时间的推移，原来的解释可能会发生变化，甚至在论文刚印刷出版后会很快发生变化。虽然讨论是科学研究中最引人注目的部分，但由于它的时效性，讨论一般不写入摘要。

结论通常采用直接陈述的方式，当结论无法很具体时，可采用“The implications of the data are discussed in detail．”等句子表述研究结果，结论也可以是对研究发现的解释或是对有意义结果的建议，但对研究工作的建议和未来的计划一般不写入摘要。

结论的顺序一般遵循论文各部分内容的次序，这样更有助于读者回想并理解全文的内容。但是，有时由于研究本身的特点或所关注的重点不同，使摘要中各部分的次序发生变化。

一篇好的摘要通常主要由研究方法和结果组成，由首句表达研究的目的，随后的句子表明得到的结论。当然这样的顺序不是一成不变的，它随着所做研究的具体情况不同而变化。

(4) 语态和时态的运用

①语态。摘要一般很短，尽量不要混用各种语态，更不要在一个句子里混用。科技论文主要说明事实，一般用被动语态。但由于主动语态比被动语态语感强，表达有力，可能情况下尽量用动词的主动语态。使用主动语态有助于避免过多使用类似于“is”、“was”、“are”和“were”这样的系动词。

例如：用“Iron-containing bauxites sweeten gasolines in the presence of air．”比用“Gasolines are sweetened by iron-containing bauxites in the presence of air．”要好。但用“The relative adsorption coefficients of ether, water, and acetylene were measured by…”比用“…measured the relative adsorption coefficients of ether, water, and acetylene．”要规范。“A exceeds B”读起来要好于“B is exceeded by A”。

在英语科技论文中，摘要中常见的被动态句型有以下几种。

The principle of…is outlined．本文概述……的原则。

The apparatus for…is described．本文描述…的装置。

An account of…is given．本文叙述……。

The use of…is addressed．本文论述……的应用。

The mechanism of…is examined．本文探讨……的机理。

The dependence of…was established．本文确定……的关系。

An analysis of…was carried out．本文作了……的分析。

以上句型中的谓语动词还常用be studied，be determined，be investigated，be presented, be proposed，be obtained等。

②时态

通常情况下，摘要中谓语动词的时态和语态都不是通篇一律的，而应根据具体内容而有所变化，否则容易造成理解上的混乱。但这种变化又并非无章可循，其中存在着如下一些规律。

叙述研究过程，多采用一般过去时。

在采用一般过去时叙述研究过程当中提及在此过程之前发生的事时，宜采用过去完成时。

说明某课题现已取得成果，宜采用现在完成时。

摘要开头表示本文所“报告”或“描述”的内容，以及摘要结尾表示作者所“认为”的观点和“建议”的做法时，可采用一般现在时。

(5) 摘要写作注意事项。

①尽量用第三人称。第一人称作主语往往带有强烈的个人感情色彩，不宜多用。至于主题句，可以用主动语态，主语为“作者”、“本文”或“本论文的目的……”；也可用被动语态。通常情况下使用如：“对……进行研究”，“进行……调查”，“分析了……现状”等，尽可能少用或不用“本文”、“作者”、“笔者”等。

②正确使用专业术语：避免使用对此项研究不熟悉的读者难以理解的专业术语、缩略语、简称及符号。为方便索引，应给出主要术语的缩写和全拼两种形式(通常第一次使用全拼形式)。缩略语和简称在摘要中首次出现宜用全称给出定义，加以说明。不应使用非公认的符号。特殊字符(数学符号)及希腊字母尽量不用或少用。不应单独使用研究论文中出现的名词或词组的缩写。

③尽量不用非文字内容。摘要一般尽可能采用文字形式。不使用图表与公式等非文字内容。摘要中的内容不加脚注。

④注重逻辑连接与连贯。多数作者不重视摘要的逻辑连接与连贯，只是逐句进行罗列，很少有巧妙的连接，使摘要的可读性大打折扣。所以在摘要写作中要注意通篇的衔接手段，特别是隐性的衔接手段(词汇手段)可将摘要组成一个意义紧密相接的整体，从而可以保证摘要意义清晰。

⑤突出重点。对新内容要重点详尽写出，着重反映创新点及取得的研究成果，取消或减少背景信息。若背景信息所占篇幅过大，会使作者所做工作显得过于笼统和简单。论文摘要的文字必须十分简练，内容亦需充分概括，篇幅大小一般限制其字数不超过论文字数的5%。例如，对于一篇6000字的论文，其摘要一般不超出300字。

摘要应用重要的事实开头，尽量避免用辅助从句开头；构成句子时，动词应靠近主语；避免罗列一大堆数据；去除本学科领域常识性内容；未来计划不列入摘要；不应引用参考文献；不应有正文中未涉及的内容；不写无用的语句，应客观、如实地反映所做的研究工作，作者不必进行自我评价；英美拼写保持全文风格一致，尽量用简短、词义清楚并为人熟知的词。

⑥论文摘要“五不”。不要列举例证，不讲研究过程，不用图表，不给化学结构式，不作自我评价。

**（3) 教学过程及方法**

采用教师讲授与学生提问相结合的教学方式

**（4) 作业安排**

阅读reading material 9，根据要求翻译一篇摘要。

**8、课程要求**

英语作为一门语言，最重要的是训练，听说读写的能力都是训练得来的。科技英语是基于普通英语之上的，建议同学们积极参与课堂提问及课堂讨论，同时在课下广泛涉猎与专业英语相关的著作、资料、新闻等，以提高学习兴趣，训练自己的专业英语的阅读和写作能力

**9、课程考核**

**9.1 出勤要求**

出勤：本课程的学习中，选课同学应该主动遵守四川理工学院学生管理条例中关于出勤的相关政策规定。本课程将采用倒扣分的形式，即对无故缺席的同学（包括课后补假的同学），每缺席1次平时成绩扣5分，直至扣完。此外，本课程允许每一位同学无理由请假2次，但需在授课前提交请假条。

迟到与早退：上课铃后进入教室的同学算迟到，下课铃响前擅自离开教室的同学算早退。5次无故迟到10分钟及10分钟以内的同学算缺席1次，1次无故迟到10分钟及10分钟以上的同学算缺席1次；1次无故早退的同学算缺席1次。**9.****2成绩的构成与评分规则说明**

根据2015年专业外语课程教学大纲要求，总评成绩主要由平时成绩组成，占100%。平时成绩主要由出勤、课堂发言、课后作业、课程报告组成。出勤不加分，仅扣分，具体扣分细节详见9.1节出勤考核方式；课堂发言主要采用同学主动发言或随机抽点的方式，教师根据题目的难易程度以及回答情况给出等级分数。每一次课后作业根据同学完成情况给出等级分数，该次作业未交者按等级“E”计，补交作业按等级“D”计。课程报告根据同学的完成情况给出等级分数。等级分数与百分制分数换算亦详见下表。

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 等级 | A+ | A | A- | B+ | B | B- | C | D | E |
| 分数 | 98 | 95 | 90 | 88 | 85 | 80 | 70 | 60 | 0 |

在出勤不扣分的情况下，最终平时成绩为每一次课堂发言、课后作业、课程报告换算成百分制分数的算术平均分。若存在出勤扣分，平时成绩为先按出勤不扣分的情况计算的算数平均分，然后再依出勤扣分标准计算最终平时成绩。

**9.3****考查形式及说明**

通常情况下，《专业外语》课程为考查课，具体考试要求按四川理工学院教务处规定执行。如果该课程总评成绩不及格（即该课程总评成绩<60分），将有且仅有一次补考机会，如果补考仍不及格，则需要重修本课程。

**10、考试违规与作弊处理**

按照学校规定执行。

**11、课堂规范**

1. 学生必须按时上课，不得无故旷课、迟到或早退。
2. 学生上课应有秩序地进入教室，不得抢占座位。应保持教学楼的肃静。
3. 课堂内学生应认真听讲，遵守课堂纪律。下课后应主动安排同学擦黑板。
4. 学生不得穿背心、内裤、拖鞋进教室，不准在教室内抽烟。
5. 学生应自觉保持保持教室整洁，不得随意吐痰、乱丢果皮、纸屑，严禁在桌椅上刻画。
6. 学生应爱护教室内的一切公物，不得搬走桌椅、不准取走电器设备，损坏公物照价赔偿。

**12、课程资源**

教材与参考书

教材：崔学军主编. 《腐蚀与防护专业英语》. 自贡：四川理工学院教材科，2015

推荐参考书：

1. 匡少平，王世颖. 材料科学与工程专业英语. 北京：化学工业出版社, 2010.

2. 李洪涛，费维栋. 材料科学与工程专业英语. 哈尔滨：哈尔滨工业大学出版社, 2001.

**13、教学合约**

学术诚信最基本的原则是学生必须保证所提交的作业是自己所做。如果在完成课业时，请教了其他同学、老师，必须在作业中注明。

学习小组是非常有益的教育途径。鼓励同学们在完成作业、准备考试时相互之间进行讨论，只要在作业最后注明参考文献、合作者信息（其目的是要感谢他对你的工作所做的贡献），在完成作业时同学之间的相互合作是允许的。未有参考文献说明，逐字照抄其他人的答案或部分答案都是学术欺诈，其他同学对你的答案有贡献但你却未注明就是作弊。

课业完成后进行的考试过程中，不得采用不诚实、欺诈或未经认可的任何手段力图通过考试或获取好成绩。学术诚信问题零容忍，学术欺诈或考试作弊行为一经证实，该课程成绩将被判不及格，情节严重者将上报学校。请同学们高度重视学术诚信问题，严格要求自己，遵守四川理工学院相关的管理规范要求。

如果同学们有对本课程实施的意见和建议，欢迎大家提出，或对你自己做更多介绍，以便我对你有更多了解。

**14、课程合作协议**

1我已阅读课程实施大纲并理解其内容；

2我同意遵守课程实施大纲中阐述的标准和期望；

3 我同意遵守本课程实施大纲中所阐述的课程考核方式、学术诚信规定、课堂规范等。

签名：

日期：