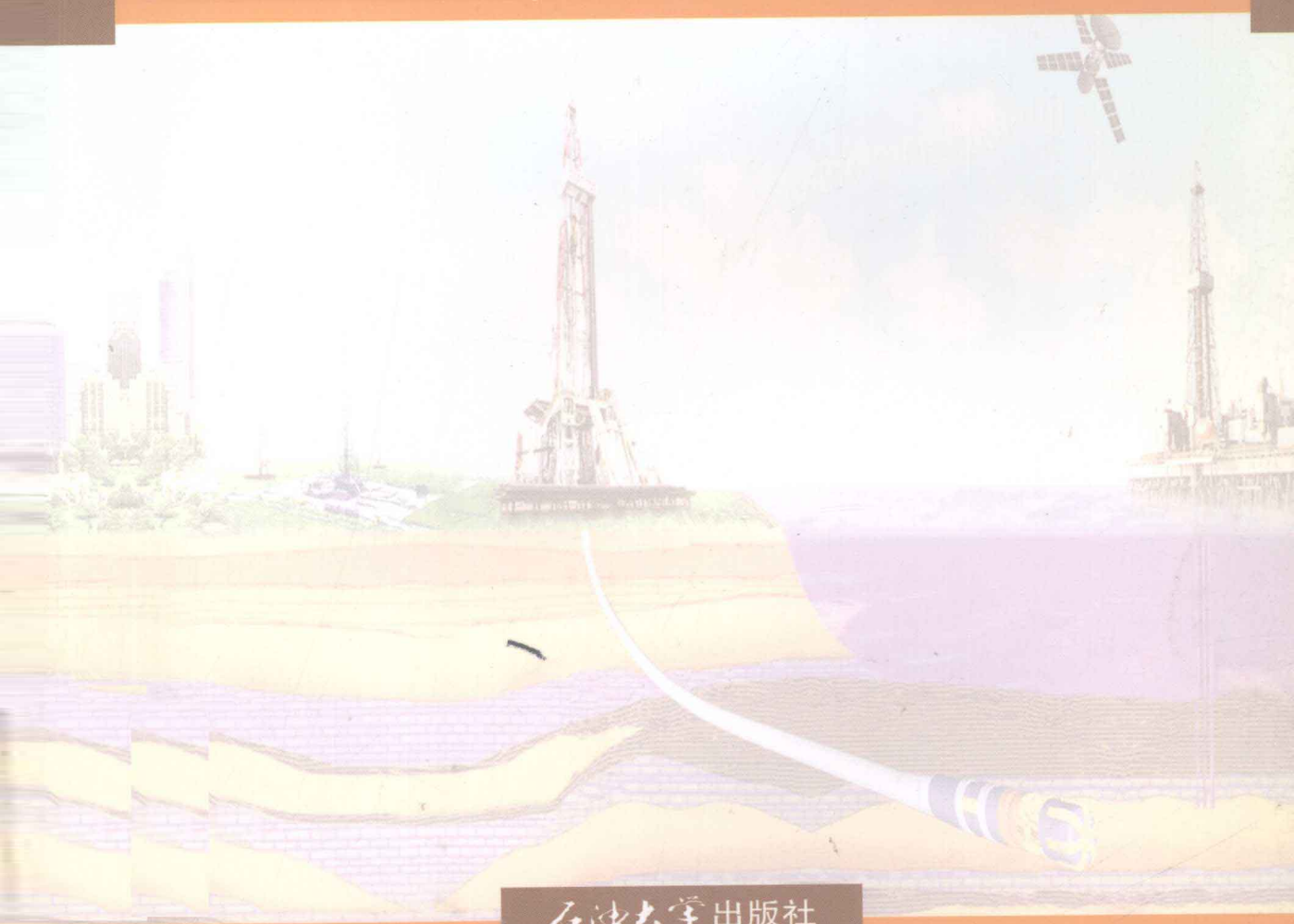
石油英语系列教材

石油钻井实用英语

主编　李洪乾　赵金海　彭军生



石油大学出版社

石油英语系列教材

Practical English for Petroleum Drilling Engineering

石油钻井实用英语

李洪乾　赵金海　彭军生　主编

石油大学出版社

图书在版编目(CIP)数据

石油钻井实用英语/李洪乾,赵金海,彭军生主编. —东营:石油大学出版社,2003.12
(石油英语系列教材)
ISBN 7-5636-1707-8

Ⅰ.石… Ⅱ.① 李… ② 赵… ③ 彭… Ⅲ.油气钻井-英语-教材 Ⅳ.H31

中国版本图书馆 CIP 数据核字(2003)第 122077 号

书　　名:石油钻井实用英语
作　　者:李洪乾　赵金海　彭军生

策　　划:江兴林　朱仁宏　蔡西茂
责任编辑:何　峰(电话　0546-8392565)
封面设计:傅荣治(电话　0546-8391805)
封面图片:马立柱

出 版 者:石油大学出版社(山东 东营,邮编 257061)
网　　址:http://www.hdpu.edu.cn
电子信箱:sanbian@mail.hdpu.edu.cn
印 刷 者:青岛星球印刷有限公司
发 行 者:石油大学出版社(电话 0546-8392563)
开　　本:185×260　印张:18.5　字数:473 千字
版　　次:2004 年 1 月第 1 版第 1 次印刷
印　　数:1-3000 册
定　　价:35.00 元

《石油钻井实用英语》编委会

主　任	席秀海			
副主任	江兴林	杨昌江	韩来聚	孙尔均
编　委	万念明	李作会	朱仁宏	李洪乾
	赵金海	彭军生	潘连栋	蔡西茂

《石油钻井实用英语》编著人员

主　编	李洪乾	赵金海	彭军生	
副主编	韩来聚	李作会	杨　利	朱仁宏
	蔡西茂	潘连栋		
参　编	刘声蓉	王晓燕	杨兆新	

编著者说明

步入新世纪、加入 WTO 后，中国面临着新的机遇与挑战。为适应我国石油领域对外交流与合作的迫切需要，提高石油科技工作者和有关涉外人员的专业英语水平与实用能力，胜利油田组织编著了石油英语系列教材。该系列教材包括石油地质、地球物理勘探、钻井、测井、采油、安全环保等专业。各专业英语教材的编著自成体系，独立成书。《石油钻井实用英语》(*PRACTICAL ENGLISH FOR PETROLEUM DRILLING ENGINEERING*)是该英语系列教材之一。

《石油钻井实用英语》全书分三大部分，第一部分是精读，课文内容以钻井地质、钻头、钻机、钻井液、钻井工艺、打捞、完井等石油钻井工程的基本概念及基础理论为主。第二部分是泛读，课文内容侧重于石油钻井工程项目的招投标管理、钻井合同的格式、HSE 的介绍。第三部分是口语与听力，采用现场对话的方式，较为全面地介绍了涉及钻井工程的相关内容。全书共 75 课，其中第一部分 20 课(10 个单元)，第二部分 24 课，第三部分 31 课。引用资料主要精选自近年来出版的英美原著和国内出版的专业英语书籍，经精简、改编而成，在编著中力求使课文既保持原著风貌，又层次清晰、重点突出，并且使全书从总体上体现连续性、系统性、可读性和实用性。

为方便读者，本书的精读和口语部分每课后面都附有生词释义及相应的音标。另外，附录一附有石油钻井常用的英语词汇，附录二和附录三分别对目前国际知名的石油公司、钻井及完井服务公司的经营业务范围进行了简要介绍，并附有每个公司的联络方式。

在中国石化胜利石油管理局教育培训处的部署下，由中国石化

胜利油田钻井工艺研究院组织，全书经过编著者的辛勤努力，几易其稿得以正式出版。编著系统而正规的石油钻井英语教材是一项浩繁的工作，由于时间仓促，水平有限，书中不妥之处在所难免，敬请读者批评指正。

编著者

2003 年 12 月

内容提要

《石油钻井实用英语》是一本石油钻井专业方面的英语实用教材。全书分三大部分：第一部分是精读，课文内容以钻井地质、钻头、钻机、钻井液、钻井工艺、打捞、完井等石油钻井工程的基本概念及基础理论为主；第二部分是泛读，课文内容侧重于石油钻井工程项目的招投标管理、钻井合同格式、HSE的介绍；第三部分是口语与听力，采用现场对话的方式，较为全面地介绍了钻井工程所涉及的相关内容。全书共75课，其中第一部分20课(10个单元)，第二部分24课，第三部分31课。

该书题材广泛、内容丰富、重点突出、结构紧凑，具有系统性、可读性和实用性，既可作为钻井涉外培训教材，又可作为钻井专业人员的英语自学用书，还可作为石油高等院校相关专业的英语教学参考书。

CONTENTS

Part One Intensive Reading

Part Two Extensive Reading

Part Three Oral Practice and Listening Comprehension

Part One

Intensive Reading

Unit 1

Characteristics of Reservoir Rock

Passage A Porosity and Permeability

The grains making up sandstones are all irregular in shape. The degree of irregularity, or lack of roundness, evidences as to how the sand grains may have been formed originally or the degree to which they subsequently have eroded. Violent crushing or grinding action between rocks causes grains to be very irregular and sharp-edged. Tumbling action of grains along the bottom of streams or seas smooths sand grains. Wind-blown sand, as occurs in moving dunes of the great deserts, results in sand grains that are even more rounded. Sand grains that make up sandstone beds and fragments of carbonate materials that make up limestone beds usually never fit together perfectly even though overburden rock pressure on these beds may be quite great.① The void space created throughout the beds between grains is called pore space.

The pore spaces in reservoir rock, sometimes called interstices, provide the containers for the accumulation of oil and gas deposits. Pore space, or porosity, in rock gives the rock its characteristic ability to absorb and hold fluids. Most commercial reservoirs of oil and gas occur in sandstone, limestone or dolomite rocks; however, some reservoirs occur in fractured shale. Knowledge of the physical characteristics of the pore spaces and of the rock itself (which controls the characteristics of the pore spaces) is of vital importance in understanding the nature of a given reservoir.

Porosity

As sand was laid down in geologically ancient seas, the first fluid that filled pore spaces in the sand was sea water or "connate" water. Some pore spaces became isolated, but the vast majority in sandstones containing petroleum deposits remained interconnected and have had water in them or moving through them throughout their existence. One method of classifying reservoir rocks, therefore, is based on whether pore spaces in which the oil and gas is found originated when the formation was laid down or whether they were formed through subsequent earth stresses or ground water action.② The first type of porosity is termed "original porosity" and the latter,

"secondary porosity". Most sandstone porosity is original while most limestones and dolomites owe their porosity to secondary formation.

Secondary porosity in limestone beds occurred as a result of fracturing, jointing, solution, recrystallization or a combination of these. Original porosity in limestone is important because such must have been present when artesian water entered and began its solution work on the limestone rock formation.

Where water is present in a carbonate formation, there is a continuous process of solution and deposition or recrystallization. If solution is greater than deposition in any zone, porosity will be developed between the crystal grains. An important type of porosity of this kind is found in dolomite zones which occur in conjunction with large limestone deposits. Dolomite may be deposited originally as a sedimentary rock, or it may be formed by replacing the calcium carbonate in limestone rock with magnesium carbonate.

Porosity is measured as a per cent of total rock volume. The most useful way to classify porosity is into categories of effective porosity (continuous or interconnected porosity), non-effective porosity (discontinuous or isolated porosity), and total porosity (the sum of all the porosity). Only effective porosity has real significance in rocks containing present-day commercial oil and gas deposits because it is only from this type of porosity that the fluids can move and be recovered.

Permeability

The ease with which fluid can move through the interconnected pore spaces of the rock denotes the degree of permeability possessed by the rock. The rock is more or less permeable depending upon whether the rock will let fluid pass through it with greater or less ease.[③] This is similar to pipelines where larger or straighter lines let fluid move through more easily. Many rocks are impervious to movement of water, oil or gas even though they may actually be quite porous. Some of these are clays, shales, chalk, anhydrite and some highly cemented sandstones.

When considering the permeability of rock, we immediately must think in terms of the force which makes fluid flow through the rock. Such force is pressure — just as in a pipe where a pressure is applied to force liquid or gas to move through the pipe. In 1856, the French engineer Henry Darcy performed tests on water filters, and some of this work provided the engineering profession with the relation which permits measurement and study of the ease of fluid flow through porous rock. Darcy's law of fluid flow states that the rate of flow through a given rock varies directly according to some numerical quantity and the pressure applied, and varies inversely according to the viscosity of the fluid flowing. The numerical quantity is the permeability and is measured in darcies. A sandstone having 1 darcy of permeability is defined as one that 1 cubic centimeter of fluid of 1 centipoise viscosity (or the viscosity of water at 68°F) would flow each second through a portion of the sand 1 centimeter in length and having 1 square centimeter of area through which to move if the pressure drop across the sand is 14.7 pounds per square inch (or equivalent to atmospheric pressure).[④]

Reservoir rock having an average permeability as great as 1 darcy is found in only a small por-

tion of the reservoirs containing petroleum deposits. The usual measure of rock permeability, therefore, is in millidarcies (md) or thousandths of a darcy.

The magnitude of permeability, in terms of oil production from a reservoir rock into a well, is illustrated by the fact that a reservoir rock 10-feet thick having 1 darcy of effective permeability will permit about 150 barrels of oil per day to flow into a well bore if the pressure in the well is 10 pounds per square inch below the pressure out in the reservoir.

New Words

1. **irregular** [i'regjulə] *a*. 不规则的,不均匀的;不整齐的
2. **irregularity** [iˌregju'læriti] *n*. 不规则性,不匀度
3. **subsequently** ['sʌbsikwəntli] *ad*. 其后,接着,其次
4. **porosity** [pɔ:'rɔsiti] *n*. 孔隙率(度),多孔性
5. **permeability** [ˌpə:miə'biliti] *n*. 渗透性(度、率),透气性
6. **characteristic** [ˌkæriktə'ristik] *a*. 特有的,有特色的 *n*. 特性(点、征、色),性能
7. **geologically** [dʒiə'lɔdʒikəli] *ad*. 地质(学上)地
8. **discontinuous** ['diskən'tinjuəs] *a*. 不连续的,间断(歇)的
9. **recrystallization** ['riːˌkristəlai'zeiʃən] *n*. 再结晶,重结晶
10. **anhydrite** [æn'haidrait] *n*. 无水石膏,硬石膏
11. **illustrate** ['iləstreit] *vt*. 图解,(用图解、举例)说明
12. **equivalent** [i'kwivələnt] *a*. 相等(同)的;当量的;等效(值、价、量)的
13. **artesian** [ɑ:'ti:zjən] *a*. 自流(水)的,喷水的
14. **impervious** [im'pə:vjəs] *a*. 不透水的,不可渗透的;不受影响的
15. **magnitude** ['mægnitju:d] *n*. 大小,尺寸,量级
16. **interstice** [in'tə:stis] *n*. 孔隙,间隙

Phrases and Expressions

1. **violent crushing** 剧烈压碎(破碎)作用
2. **tumbling action** 翻滚作用
3. **sedimentary rock** 沉积岩
4. **magnesium carbonate** 碳酸镁
5. **calcium carbonate** 碳酸钙
6. **in conjunction with** 和…一起(共同)
7. **atmospheric pressure** (大)气压(力)
8. **connate water** 原生水,共存水,共生水
9. **artesian water** 自流水

Comprehension

1. Sand grains that make up sandstone beds and fragments of carbonate materials that make up

limestone beds usually never fit together perfectly even though overburden rock pressure on these beds may be quite great.

这是一个主从复合句，首先由“even though”引导一个让步状语从句。在主句中，又由两个“that”引导两个定语从句，分别修饰“sand grains”和“fragments of carbonate materials”。全句的意思是：形成砂岩层的砂粒和形成灰岩层的碳酸盐片状物质，即使在作用到这些岩层上的上覆岩层压力很大的情况下，通常也绝不会完全结合在一起。

2. One method of classifying reservoir rocks, therefore, is based on whether pore spaces in which the oil and gas is found originated when the formation was laid down or whether they were formed through subsequent earth stresses or ground water action.

这是一个主从复合句，首先由两个“whether”引导两个并列的宾语从句。在第一个从句中又有一个由“in which”引导的定语从句，修饰“pore spaces”。全句的意思是：因此，给储集层分类的一种方法就以含油气的孔隙是起源于地层被沉积时还是通过后来地应力或地下水的作用而形成为基础的。

3. The rock is more or less permeable depending upon whether the rock will let fluid pass through it with greater or less ease.

本句中“depending upon”是现在分词短语作状语，其中有“whether”引导的一个宾语从句。全句的意思是：岩石的渗透性是好还是差，取决于流体从中通过的难易程度。

4. A sandstone having 1 darcy of permeability is defined as one that 1 cubic centimeter of fluid of 1 centipoise viscosity (or the viscosity of water at 68°F) would flow each second through a portion of the sand 1 centimeter in length and having 1 square centimeter of area through which to move if the pressure drop across the sand is 14.7 pounds per square inch (or equivalent to atmospheric pressure).

这是一个主从复合句，首先由“that”引导一个定语从句，修饰“one”。在这个定语从句中又有一个“if”引导的条件状语从句。全句的意思是：渗透率为 1 达西的砂岩被定义为如下的一种：如果砂岩上的压降为 14.7 磅/平方英寸(或者相当于大气压力)，粘度为 1 厘泊(或者 68°F 时水的粘度)的 1 立方厘米的流体每秒钟内会流经长度为 1 厘米、流动面积为 1 平方厘米的一段砂岩。

Exercises

1. Answer the following questions:

(1) What is pore space?

(2) What kinds of rock do most commercial reservoirs of oil and gas occur in?

(3) How is porosity measured?

(4) What is the most useful way to classify porosity?

(5) What denotes the degree of permeability possessed by the rock?

(6) What does Darcy's law of fluid flow state?

(7) How is a sandstone having 1 darcy of permeability defined?

2. *Fill in the blanks*:

(1) The first type of porosity is termed _____ and the latter, _____.

(2) Secondary porosity in limestone beds occurred as a result of _____.

(3) Only _____ has real significance in rocks containing present-day commercial oil and gas deposits.

(4) The rock is more or less permeable depending on _____.

(5) Reservoir rock having an average permeability as great as 1 darcy is found _____ _____.

3. *Translate the following into English*:

(1) 岩石内的孔隙为其提供了吸收和保存流体的特有能力。

(2) 如果溶解作用大于沉积作用,晶粒间就会形成孔隙。

(3) 当考虑岩石的渗透率时,我们一定会马上想到使流体流经岩石的力。

Passage B Factors That Influence Porosity and Permeability

Porosity and permeability of sandstone depend upon many factors, among which are size and shape of the grains, variations in size of grains, arrangement in which grains were laid down and compacted, and amount of clay and other materials which cement the sand grains together.①

Sizes of the sand grains which make up a rock do not influence the amount of porosity occurring in the rock. However, variations in sand-grain sizes do influence considerably the per cent of porosity. Porosity between spheres of 1-inch diameter is the same as porosity between spheres of ½-inch diameter, provided the spheres are arranged in the same manner. If they are arranged in cubic order, porosity is about 48 per cent; whereas if they are arranged in rhombohedral order, porosity is about 26 per cent. If spheres of varying sizes are packed together, porosity may be any amount from 48 per cent to a very small amount approaching 0 per cent. This principle is illustrated in mixing concrete where the basic materials are gravel mixed with sand, with the resulting mixture having very little porosity and requiring only a small amount of cement and water to fill the remaining pore space completely.

To illustrate variation in porosity and permeability with a given type of sand grain, various features are considered separately. If the sand grains are elongated or flat and are packed with their flat surfaces together, porosity and permeability may both be low. Permeability along the flat surfaces will be higher, however, than the permeability in a direction that is perpendicular to, or across, the flat surfaces of the grains. In a reservoir, the permeability horizontal with the bed is usually higher than the permeability vertical across the bed because the process of sedimentation, where the sand grains are washed to their final position, causes the grains to be laid down with their flattest sides in a horizontal position.②