科技英语阅读

主编 黄振奇 吴 献 赵新军

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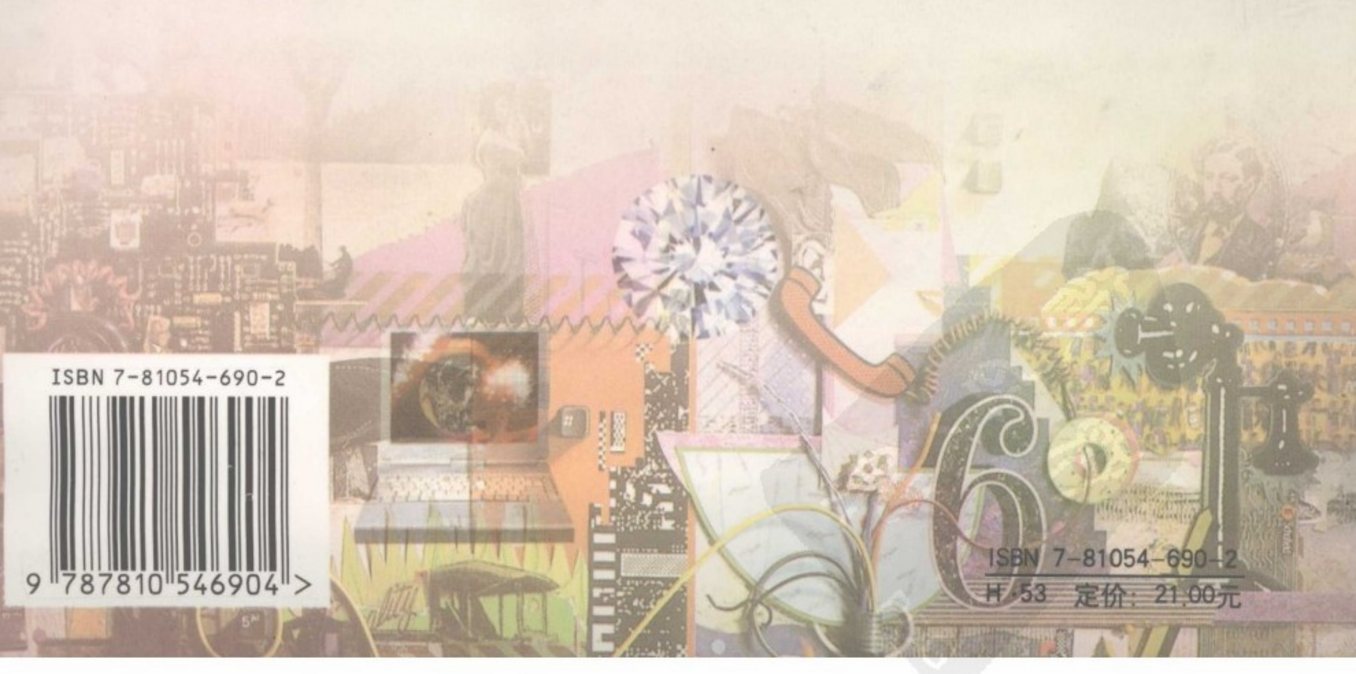

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序　言

科技英语的突出特点是长句多、结构嵌套复杂，词语间限定严谨。单词、词组、语句群体间的逻辑归属不仅由语法规律决定，而且往往与专业知识密切相关。只有了解某些关键词语在相关专业中的准确含义，才能正确把握长句的语感和语流。语流体现单词间的语法联系，语感则反映语句群体在句子中的逻辑地位。因此，本书将对典型长句从科技角度进行逻辑分析，将长句分解为多个逻辑群体，各个击破之后，组装成具有专业规范，符合汉语习惯的英译汉译文。

科技英语阅读应以英语语法概念为线索来判别词语的走向和归属，从而找出句子中的主、谓、宾、补、定、状成分。科技英语中的定语复杂，只有弄清定语的限定范围，才能走出长句的迷宫。

本书拟以新颖的素材、趣味性的选题和可读性的资料，集中材料工程、矿物工程和机械工程领域的最新科技成果，激发和唤起学生的阅读兴趣。以使学生在科技英语阅读过程中，不但积累专业词汇，而且了解科技最新知识。

本书打破公共英语传统的“阅读—理解”模式，遵循科技英语的固有规律，将科技英语阅读引导到“理解—归纳”模式上来。侧重理解每个句子的准确含义，对某些典型例句给出参考译文，使学生了解和掌握科技英译汉的基本原则与技巧。

书后给出的生词不要求学生全部记住。每一条目中的第一个词是从课文中选出的，余者只是该词的同音词、同系列词、同义词、同形词、同根词或反义词。不仅仅是词汇的罗列，也是记忆单词的方法，希望能开阔学生视野，有助于扩大词汇量。

本书分三大部分：第一部分是冶金工程与材料科学方面的内容，由黄振奇收集整理，给出生词解释和参考译文；第二部分是资源与土木工程方面的内容，由吴献收集整理，给出生词解释和参考译文；第三部分是机械工程与自动化方面的内容，由赵新军收集整理，给出生词解释和参考译文。全书由黄振奇统一编排、审阅。

本书是在东北大学教务处直接指导下完成的。在此，对教务处有关领导和同志的关怀表示深深的感谢。

编　者

2001年5月

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Part Ⅰ Metallurgical Engineering and Materials Science

Part Ⅱ Resources and Civil Engineering

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Part Ⅰ　Metallurgical Engineering and Materials Science

Unit 1

阅读本课，你会知道：

——塑料和超导体是21世纪的两种新型材料

——未来的汽车将用30%塑料代替钢结构，用氮陶瓷做引擎，可在更高的温度下运行

——未来的材料将模仿自然界某些生物（如蜻蜓翅膀），将其制成蜂窝状结构

Tomorrow's Materials

ET-extraterrestrial? No, it's short for ethylenedithio tetrathiafulvalene, a completely new type of metal which is superconducting at the unusually "high" temperature of around 270℃ below the freezing point of water! Actually, much higher superconducting temperatures have now been achieved, in a new breed of oxide ceramics. These are just two of the new materials that we may meet in tomorrow's world—the world of the twenty-first century. It will not be such a different world to the one we live in today, perhaps, though it will be sufficiently changed to be noticeable.

You'll be driving a somewhat lighter car than your current one, partly because plastics and cellular composites will have replaced about 30% of the steel in its construction, and partly because much of the engine will consist of lightweight nitrogen ceramics which allow it to run at a higher temperature.[1] These changes should please you, because the fuel consumption will be around half of what it is today. You'll drive to work over a fibre-reinforced "flexible" concrete bridge of a new lightweight tubular construction. The thin concrete sections, manufactured at the factory, will be glued together on-site using a new super-strong polymer glue. The telephone and the electrical and electronic functions in the car will be controlled by a tiny computer based on gallium arsenide, or maybe even plastic (polyactylene) chips.

These predictions are not the result of gazing into a crystal ball, but are based on an appraisal of current research in leading materials laboratories around the world. Since some ten to fifteen years usually pass between the beginning of application-oriented research and the production line, tomorrow's materials, based on the most promising of today's research, may be almost commonplace by the turn of the century.

Of course, in discussing the likely materials of tomorrow's world it is not enough to consider current research. In a dynamic world of changing political frontiers, shrinking distances, widening information networks, and growing environmental concern, attitudes to the production and use of materials will also change, probably radically.[2] All current trends in materials research point to a much more efficient use of materials in the future. For materials which are becoming scarce this approach is obvious, and research must aim to find alternative materials to replace the old ones. But this is only a small part of the picture. Materials of the future will be produced more efficiently than ever before, with emphasis on fewer operations and much less wastage in producing the final shape. Recycling old materials is already an area of growing importance, and in this respect the non-biodegradable coffin and many other synthetic polymers will be the objects of considerable research. The Italian Government has decreed that only degradable plastic bags will be available for shoppers after the year 1991. In other words, tomorrow's materials will provide the basis of a manufacturing technology which is more energy-conscious and environmentally responsible than today's, in terms of both material production and application.[3]

You might think that we already have quite enough materials to see us into the next century. A look at manufactures' catalogues reveals tens of thousands of materials from which to choose. In spite of this tomorrow's engineering designer will certainly have a great deal more from which to choose than his predecessors of today. For example, although there are currently about 15, 000 different plastics available, it is predicted by scientists that this number will double by the year 2000. This is not to imply, of course, that all today's materials will continue to be manufactured tomorrow. On the contrary, changing attitudes to use and production will result in better, more sophisticated materials, designed to widen their application and provide more economical and lighter structures. Furthermore, metallurgists and ceramists are as active as their polymer colleagues in developing new products, and competition between these industries may well sharpen in the future.[4]

The new century will witness completely new types of materials. We are now getting some spectacular insights into tomorrow's materials from the natural world, from investigations of cross-sections of dragonflies' wings, the composition of spiders' legs, the mechanics of holly leaves, the microstructure of seashells and coral, and the "superglue" used by mussels.[5]The purpose of this work is to find how to apply the techniques of Nature to the design of tomorrow's light-weight cellular and composite structures. The results of studies like this may lead to better designs for sandwich panels (these are honeycomb structures glued between hard outer sheets).

Against a background of changing attitudes, closer interaction between tomorrow's materials scientists and engineering designers is of paramount importance. This is necessary not only to enable designers to take advantage of the exciting new materials becoming available, but also to provide a basis for developing even better materials and technologies in the future.[6] Even now, materials scientists know so much about what gives materials their various thermal, optical, electrical, and mechanical properties, that they can in effect design materials to fit a particular application in the same way that the mechanical engineer designs the shape of struts in a bridge or panels in a spacecraft.[7]

Before getting down to the finer details of tomorrow's materials, it is useful for the non-specialist to consider briefly what it is that gives materials the properties they actually possess. For example, when is a metal not a metal? When do polymers behave more like metals? What's the difference between a plastic and a ceramic? We shall see that while the traditional division of materials into metals, polymers, and ceramics has been useful in the past, in the modern, wider approach to the structural properties and applications of materials it is better to consider materials under more general headings.[8] When a designer comes to select a material for a particular application, all possible materials will then begin on a more or less equal footing, irrespective of their species. We shall see that a suitable division of materials can be made under the four headings *crystalline*, *amorphous*, *composite* and *cellular*. We begin with a discussion of crystalline and amorphous materials.

☞ New Words and Expressions

1. extraterrestrial 地球外的，宇宙的。terrene 地球，陆地，地质的。terrestrial 地球，大地。celestrial 天空，天体的
2. ethylenedithio 二硫乙烯。ethylene 乙烯。thio 含硫的，硫代（氧）的
3. tetrathiafulvalene 四硫代富维林。thiamin 硫胺（维生素 B_1）
4. breed 使繁殖，种类。hybrid 混血儿，混合物。creed 信条，教条。ceek 溪流，小溪。creep 爬，蜿蜒。scrip 便条，字条。script 手稿，笔试卷。scriptorium 写字间。scripture 手稿，圣经
5. cellular 细胞的，多孔的。cellular telephone 移动电话。cellular glass 海绵状玻璃。cellular technology 蜂窝技术。cellular phone 便携式电话
6. flexible 柔韧的，灵活的。flexibility 适应性，机动性。flexibility report 可行性报告
7. tubular 管状的。tube 管子，地铁（英），电子管（美）。tuberculosis 肺结核
8. glue 胶水。clue 线索。glow 发光。glowworm 荧火虫。gloom 阴暗
9. polyacetylene 聚乙烯。polystyrene 聚苯乙烯
10. chip 碎片，筹码，芯片。chip-proof 不破碎的。cheap 便宜的。cheapie 便宜货。clip 夹子
11. gaze 凝视。stare 注视。gape 打呵欠，豁口，呆视。gap 缺口。cap 帽子。empty talk 空话
12. appraisal 评，估价。praise 赞美。appreciate 鉴赏；增值，涨价。depreciate 贬值，贬低。flatter 奉承
13. commonplace 平凡的。lofty 高贵的。courtlike 高雅的，有礼貌的。despicable 卑劣的

14. radical 根本的，根。ridiculous 荒唐的，可笑的。absurd 荒谬的。basic 基本的，碱性的。basilic 重要的
15. biodegradable 生物（所能）分解的。degrade 降级，退化。prograde 同向旋转（运行）的。intergrade 中间等级，过度阶段。undergrade 大学生
16. predecessor 前辈，前任。successor 继承者，后继。intercede 调解。
17. dragonfly 蜻蜓。dragon 龙，凶暴的人。phenix（phoenix）凤凰。peafowl 孔雀。peacock 孔雀。malachite 孔雀石
18. spider 蜘蛛，设圈套者。spade 铲子。spice 香料，情趣。species 物种，核素。specimen 标本，样品
19. holly 冬青树。hollow 空洞的，空的。haul 用力拖拉
20. coral 珊瑚。moral 道德的。amber 琥珀。agate 玛瑙。jade 玉，翡翠。
21. spectacular 壮观的，引人入胜的。grandiose 宏伟的，庄严的。magnificent 华丽的，宏伟的。grand 盛大的，豪华的。fascinating 迷人的
22. insight 洞察力，见识。sight 视力，眼界。insignia 勋章，徽章。scene 场面
23. strut 支柱，压杆，支撑，大摇大摆地走
24. mussel 贻贝，蚌。muscle 肌肉。muscular 肌肉的。vein 静脉血管。vain 徒劳的。artery 动脉，命脉
25. lily 百合，洁白的。rose 玫瑰。lotus 荷花。locust 蝗虫
26. honeycomb 蜂房。comb 梳子，蜂巢。butterfly 蝴蝶。fly 苍蝇。mosquito 蚊子。flea 跳骚。bedbug 臭虫。bug 小虫
27. paramount 极为重要的。trivial 轻微的。surmount 超越，战胜。demount 拆卸。dismount 下马。mount 上马
28. spacecraft 太空船。aircraft 飞机。craft 工艺，手艺。crafty 狡猾的，善于骗人的。cunning 狡猾的

☞**Notes**

1. You'll be driving ... at a higher temperature. 那时，你将驾驶着一台更轻便的汽车，比你现有的这台轻便得多。原因之一是到那时，塑料和蜂窝状复合材料将代替汽车钢结构的30%左右；另一个原因是那时的引擎将由更轻的氮陶瓷制成，使引擎能在更高的温度下运行。
2. In a dynamic world of ... probably radically. 在这风云变幻的世界中，随着（感觉）距离的缩短、信息网络的扩展以及对环境的不断关心，人们对材料生产和利用的态度也可能会发生根本的变化。
3. In other words ... production and application. 换句话说，未来的材料将提供制造工艺基础。比现在的材料在生产和利用两个方面更具有能量和环境意识。
4. Futhermore ... may well sharpen in the future. 此外，冶金学家和陶瓷学家也像聚合物专家伙伴那样，在开发新产品过程中，相当活跃。未来，这些工业之间的竞争可能会相当激烈。
5. We are now getting some ... used by mussels. 对于未来的材料，我们正从自然界获取

越来越多的启示：诸如蜻蜓翅膀的横截面、蜘蛛腿的组成、冬青叶的机理、海贝壳和珊瑚的微结构、蚌类体内的“超级胶”等。

6. **This is necessary not only to . . . technology in the future.** 这不仅使设计者能够采用现有新材料的优点，而且还可为未来开发更好的材料和工艺技术提供基础。

7. **Even now, . . . panels in a spacecraft.** 即使现在，材料科学家对于哪些因素可影响材料的各种热学的、光学的、电学的以及力学的性质，也已经掌握了相当多的知识。借此，他们可以像机械工程师设计桥梁上的支撑或飞船上的嵌板那样，有效地设计各种材料，以满足某种特殊应用的要求。

8. **We shall see that . . . under more general headings.** 我们将认识到，过去把材料分为金属、聚合物和陶瓷历来是有益处的。而在当代，随着材料结构性质和应用的拓宽，最好在更普遍的分支下来考虑材料问题。

Unit 2

阅读本课，你会知道：

——1996～2000 年中国钢铁发展策略
——提高钢质量的办法是什么？
——合资企业中，中国公司占有的股份

Joint Venture in China

In terms of crude steel production, China has had a remarkable growth that is outstanding in the history of the steel industry. In 1975, at the time of the Lima Convention, China produced 24 million tonnes of crude steel. This increased rapidly over the next 20 years reaching 93 million tonnes in 1995. In the seven years from 1988 to 1995, production increased from 59 million tonnes to 93 million tonnes, a growth of more than 50 percent. In terms of processes employed in 1995 the basic-oxygen converter accounted for 41.2 million tonnes, the electric furnace for 20.8 million tonnes, and the open hearth process for 14.4 million tonnes. Other processes accounted for 13.1 million tonnes. This rapid growth was due, in great part, to the construction of greenfield-site plants.

In 1995, the government decreed that in the period 1996 to 2000 emphasis would be placed on quality rather than quantity, and the construction of three 10 million-tonne integrated steel plants, which had been planned, was indefinitely postponed.[1] By the year 2000, it is planned to increase production to 105 million tonnes. This allows for the construction of one greenfield-site plant at Ningbo that will produce 1.6 million tonnes of crude steel. Currently under construction, it is a joint venture involving Boashan Iron and Steel, Zheyong Iron and Steel, and a foreign partner.

Emphasis on quality is much needed in view of the fact that the amount of steel continuously cast throughout China is 47 percent of its output. This ratio does, however, represent a significant increase since 1988 when it was only 12 percent. The improvement in quality is needed through additional continuous casting, particularly with the development of the automobile industry in China, which has grown significantly in the last few years from a production of 647,000 vehicles in 1988 to 1,350,000 in 1994.[2] The demand for quality steel sheets to manufacture passenger car bodies has also increased, with the number of cars produced rising from 10,500 units in 1988 to 250,000 units in 1994. Adjustments to steel finishing facilities will also be required to improve the surface and general quality of the sheets needed for automobile bodies.

Joint ventures that have taken place in the Chinese steel industry include those that are necessary for the production of finished products such as galvanized sheets. A 100,000-tonne galvanized sheet plant is being installed in a joint-venture arrangement involving Pohang Iron and Steel Company (POSCO) of Republic of Korea, which is set to supply the high-quality cold-rolled coils to be galvanized. POSCO has taken a 40 percent ownership share of the project, with 30 percent divided equally between two Republic of Korea trading companies, Postrade, the trading unit of POSCO, and Sunkyong. The remaining 30 percent is owned by China's National Ferrous Metal Corporation.[3]

A number of other joint ventures have been entered into with steel companies outside China, principally in Japan and Republic of Korea. In one such venture, Japan's Nippon Steel Corporation (NSC) and China's Laiwu Iron and Steel are building a 500,000 tonne mill for heavy sections, with the equipment being supplied by the Japanese company.[4]

Japan's second largest steelmaker, NKK, is reconstructing one of its former pipe mills in China on a joint-venture basis, having taken a one-third share of the project. Two Japanese trading companies, Marubeni and Mitsubishi, have shares of approximately 20 percent and 10 percent, respectively, while two Chinese enterprises, Huabei Petroleum and China Petroleum and Equipment Corporation, control the balance.[5]

Another steel segment targeted for joint ventures has been tinplate production. NSC holds one-fourth of China's Pacific Tinplate Company, which is building a 150,000-tonne tinplate line using technology and equipment supplied by NSC. Two Japanese trading companies, Mitsui and Itochu, equally control another 40 percent of the project, with 20 percent owned by Tinplate of Hong Kong and the remaining 15 percent shared equally by China's Guangzhou Beer and the Guangzhou Economic and Technical Development Corporation.[6]

The Japanese trading company, Nissho-Iwai, is spearheading another tinplate joint venture known as National Non-Ferrous Metal Industry Hainan Company, which is installing a 200,000-tonne tinplate facility. Nissho-Iwai, which has a 5 percent share, will supply the required blackplate from a number of Japanese mills, while two Republic of Korea participants, Daewoo and Dong Yong Tinplate, hold ownership of 43 percent and 15 percent, respectively. The remaining 37 percent is owned by the new Chinese tinplate company.

A number of coil centres for the processing of steel coils and their distribution to end users has been established in China. In one of these, Nichimen has 80 percent of the ownership, while another centre has Mitsubishi of Japan as a partner. In the latter operation, the Japanese hold 70 percent of the ownership.

☞ New Words and Expressions

1. decree 法令，颁布法令。act 法令。promulgate 发布，公布
2. integrate 结合，积分。integer 整数。integration 综合。integrity 正直，完整。integrodifferential 微积分的。calculus 微积分学，结石
3. postpone 推迟，使延期。defer 延期。confer 授予，赠与；协商。infer 推断。prefer 更喜欢
4. vehicle 车辆。conveyance 运输，转让。carriage 车辆。passenger car 公交车
5. adjustment 调整。justify 证明。justice 正义。adjacent 邻近的
6. facility 容易，熟练，工具，设备。difficulty 困难。faculty 本领，能力，（大学的）科、系，全体教员。facultyman 教员，教授。faculty advisor 指导教师
7. galvanize 通电流，电镀。galvanometer 检流计。galvanomagnetic 电磁的。galvanotropic 向电性的。galvanotactic 趋电性的
8. segmet 分割，片断。section 部分。fraction 分数。portion 部分。division 部门。subdivision 亚门，细分。cleave 劈开
9. ownership 所有权。ownerless 无主的
10. heavy sections 大型材
11. tinplate 镀锡板，马口铁。tinpot 不值钱的，不足取的
12. spearhead 充当先锋，先头部队。pioneer 先驱，倡导者
13. blackplate 未镀锡的黑钢板

☞ Notes

1. In 1995 . . . indefinitely postponed. 1995 年政府规定，在 1996 至 2000 年期间，钢铁生产应强调质量而不是数量。故已经纳入计划的三个一千万吨级联合钢铁厂被无限期地拖延下来。
2. The improvement . . . 1,350, 000 in 1994. 特别是随着汽车工业在中国的发展（在过去几年中已经明显增长：1988 年 647,000 台，到 1994 年 1,350,000 台），通过附加连铸提高质量是必要的。
3. POSCO has taken . . . by China's National Ferrous Metal Corporation. 韩国浦项钢铁公司在合资企业中持有 40% 股份，两家韩国贸易公司：Postrade 和 Sunkyong 公司平均持有 30% 股份。其余 30% 股份由中国金属公司持有。
4. In one such venture . . . by the Japanese company. 其中，新日铁公司和中国莱芜钢铁厂正在建设一座年产能力为 500,000 吨的大型材轧钢厂，其机械设备均由日本公司提供。
5. Two Japanese trading companies . . . control the balance. 两家日本贸易公司：Marubeni 和三菱公司分别约占 20% 和 30% 的股份。其余股份由两家中国企业：华北石油公司和中国石油设备公司持有。
6. Two Japanese trading companies . . . Technical Development Corporation. 两家日本贸易公司，Mitsui 和伊腾忠平均分担了该项目的 40% 股份，20%股份由中国香港马口铁厂持有，其余 15% 股份由中国广州啤酒厂和广州经济技术开发公司平均持有。

Unit 3

阅读本课，你会知道：

——形状记忆合金在加热时可恢复其初始形状
——典型的形状记忆合金包括 Cu-Zn 合金和 Ni-Ti 合金
——形状记忆合金的形状恢复机理还不十分清楚

Shape-memory Materials

The shape-memory phenomenon manifests itself when a shape-memory-alloy (SMA) is plastically deformed in the low temperature martensitic condition, and upon removal of the external loads regains its original shape when heated. The exact mechanism by which the shape recovery takes place is not very well understood, however, the process of regaining the original shape is known to be associated with a reverse transformation of the deformed martensitic phase to the higher temperature austenitic phase.[1]

Typical materials which exhibit the shape-memory effect include the copper alloy systems of Cu-Zn, Cu-Zn-Al, Cu-Zn-Ga, Cu-Zn-Sn, Cu-Zn-Si, Cu-Zn-Ni, Cu-Au-Zn, Cu-Sn, and the alloys of Au-Cd, Ni-Al, and Fe-Pt. Nitinol, a nickel-titanium alloy, is the most common of the SMAs or transformation metals.[2]

Nickel-titanium alloys (Nitinol, NiTi) acquire their name from Ni (Nickel) -Ti (Titanium) -NOL (Naval Ordnance Laboratory). NiTi alloys, featuring a near-equiatomic composition, can be plastically deformed in their low temperature martensitic phase and then be restored to the original shape by heating them above the characteristic transition temperature.[3] Typically plastic strains as high as 6% to 8% can be completely recovered by heating the Nitinol in order to transform it to the austenitic phase, and constraining it from regaining the memory shape can result in stresses of 100,000psi, for example.

There is a substantial database on the thermal, electrical, magnetic, and mechanical characteristics of Nitinol, however, the influence of residual stresses and high temperatures associated with the fabrication and processing of Nitinol-based composites, for example, is not well understood.[4] Furthermore, the extent, duration and repeatability of the shape-memory effect as well as the dynamic actuator and sensing characteristics of Nitinol are also not understood. Shape-memory effects in alloys and metals are characterized by deformation mechanisms which are associated with shape changes due to martensitic transformations. Therefore a thorough understanding of martensitic transformations is an important prerequisite to the understanding of the shape-memory effect in alloys and metals.

The transformation of steel in a high-temperature austenitic phase to a low temperature martensitic phase was first observed by the German metallurgist Adolf Martens. The extremely fine structure observed in the martensitic phase results from a lattice transformation without atomic diffusion. The face-centered cubic austenite transforms into body-centered cubic lattices or body-centered tetragonal lattices. These diffusion-free martensitic transformations manifest themselves in a variety of alloys and metals.

Martensitic transformations fundamentally involve a lattice transformation featuring shear deformation and a coordinated atomic movement, which maintains a one-to-one lattice correspondence between the lattice points in the parent phase and the transformed phase.[5] The martensitic phase is a substitutional or interstitial solid solution. The transformation is diffusion-free which yields the same concentration of solute atoms dissolved in the martensitic phase as in the parent phase. Martensitic transformations are typically characterized by well-defined shape changes or surface reliefs.

Furthermore scratch lines etched on the surface of a typical specimen in the parent phase become distorted at the boundaries between the phases as a consequence of martensitic transformation. The orientation of the surface relief and the distortion of scratch lines are very well-defined through quantitative descriptions which are strongly dependent upon the crystal orientation of the parent phase. The formation of surface reliefs and distortion of scratch lines clearly demonstrates that shearing deformation is involved in the transformation mechanism.

Martensitic crystals are necessarily characterized by lattice defects due to the complementary slip and twinning deformations which are induced by the shearing deformations which change the parent phase lattice. These complementary deformations are characterized by the lattice invariant strain, and dislocation stacking and twinning faults associated with these complementary deformations have been experimentally observed through electron microscopes.[6] The twinning faults play a significant role in the shape-memory effect.

The transformation from the parent phase to the martensitic phase can be induced only when the chemical free energy of the martensitic phase is lower than that of the parent phase. Furthermore, the difference between the chemical free energies of the two phases must be greater than the nonchemical free energy, such as strain energy or interface energy, in order to provide the excess of non-chemical free energy which is the essential driving force for the transformation.[7]

The equilibrium temperature, which is defined as the temperature at which the chemical free energy of the martensitic and parent phases are equal, plays a critical role in the transformation thermodynamics. The material must be suitably cooled to a specific temperature below the equilibrium temperature in order to ensure a sufficient excess of chemical free energy which subsequently initiates the transformation. In ferrous alloys this