

ENGLISH LANGUAGE I
-lectures and exercises-
METALLURGY AND TECHNOLOGY

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week 6

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Chapter 6 Composites

6.1 Introduction

Task 1. Work with a partner. Fill the gaps in the text with words from the box in their correct form.

artificial; aerospace; bone; cellulose; corrosion; dissimilar; phase; transportation; underwater; wood

A number of composites occur in nature: consists of strong and flexible fibers surrounded and held together by a stiffer material called lignin. is a composite of the strong yet soft protein collagen and the hard, brittle mineral apatite. Yet many modern technologies require materials with unusual combinations of properties that cannot be met by natural composites or the conventional metal alloys, ceramics and polymeric materials. This is especially true for materials that are needed for, and applications. Aircraft engineers for example, are increasingly searching for structural materials that have low densities, are strong, stiff and resistant to *abrasion* and *impact* as well as, a rather impressive combination of characteristics. The problem is that strong materials frequently are relatively dense, i.e. heavy. Increasing the strength or stiffness typically results in a decrease in impact strength.

KEY

- wood
- cellulose
- bone
- aerospace
- underwater
- transportation
- corrosion

Generally speaking, a composite is considered to be any made multiphase material that shows properties of both *constituent phases* so that a better combination of properties is realized. The constituent phases in a composite are chemically and separated by a distinct interface. Many composite materials are composed of just two, the one phase being the matrix, which is continuous and surrounds the other phase, which is often called the *dispersed* phase.

The properties of composites are a function of the properties of the constituent phases, their relative amounts and the geometry of the dispersed phase, which means the shape, particular size, distribution and orientation of the particles.

(from Callister, modified and abridged)

KEY

- artificially
- dissimilar
- phases

Glossary

abrasion, to abrade	the process of being rubbed away by friction, to rub away
abrasive, <i>n, adj</i>	a substance that abrades, abrading
impact	a high force or load acting over a short time only
constituent phase	one of the <i>phases</i> from which a substance is formed
phase	a form or state of matter (solid/liquid/gas/plasma) depending on temperature and pressure
interface	the area between systems where they come into contact with each other
to disperse, dispersion, <i>n</i>	to distribute particles evenly through a medium

Task 2. Work with a partner. Answer the following questions.

What is the number of individual materials a composite is composed of?

.....

What is the design goal of a composite?

.....

.....

KEY

- 1 Two or more
- The design goal is to achieve a combination that is not exhibited by any single material, and also to include the best properties of each of these materials.

6.2 Case Study: Snow Ski

A modern ski is a relatively complex composite structure, consisting of many parts, being composed of different materials:

the base: compressed carbon (carbon particles embedded in a plastic matrix); hard and abrasion resistant; provides appropriate surface

the top: ABS plastic having a comparatively low *glass transition* temperature; used for controlling and cosmetic purposes

the core: polyurethane plastic; acts as a filler

the core wrap: bidirectional layer of fibreglass; functions as a *torsion* box and bonds outer layers to core

the side: ABS plastic, cf. top

the edge: hardened steel; facilitates turning by cutting into snow

the *damping* layer: polyurethane; improves *shatter* resistance

(from Callister, modified and abridged)

Glossary

glass transition temperature T_g	the temperature at which, upon cooling, a non-crystalline ceramic or polymer transforms from a <i>supercooled</i> liquid to a solid glass
supercooled	cooled to below a phase transition temperature without transforming
torsion, torsional, <i>adj</i>	the stress/deformation caused when one end of an object is twisted in one direction and the other end is twisted in the opposite direction
to damp(en)	to make sth less strong, to soften
to shatter	to suddenly break into pieces

Task 1. Work with a partner. Draw the cross-section of a snow ski, showing the different layers of the composite structure as described.

KEY

- Provide: Ceramics can provide insulation.
- Be used for: Aluminium is used for light-weight constructions.
- Act as: Graphite can act as lubricator.
- Function as: Composites function as structural materials in aerospace engineering.
- Facilitate: The lotus effect facilitates keeping surfaces clean.
- Improve: Fiber reinforcement improves tensile strength.

6.3 Grammar: Gerund (-ing Form)

The gerund (after Latin *gerundium*), also called –ing form, is identical in form to the present participle as in the sentence:

Talking to Mr. Brown, she left the room.

In this sentence, the present participle *talking* stands for *while she was talking*, and is used to abbreviate the sentence. Some linguists do not differentiate between the gerund and the present participle, but most English grammar books explain the usage of the gerund in a separate chapter.

Formation of the Gerund

Task 1. Fill in the missing forms.

Add -ing to the infinitive of a verb.

to avoid –

Drop the end-e.

to freeze –

Double the final consonant when it is preceded by a stressed vowel.

to stop –

KEY

- avoiding
- freezing
- stopping

Use of the Gerund

The gerund can be used like a noun, and it can be modified by determiners like direct and indirect articles (the, a), or pronouns (my, your).

The freezing of water is one of the most common transformations in nature.

The gerund can be used like a verb and have an object.

They finally stopped questioning all information.

Note that some verbs can be used with both the gerund and the infinitive with a change in meaning. These verbs and examples are listed in any English grammar book.

Gerund after Prepositions

Task 2. Work with a partner. Use the gerund and form meaningful sentences with the prepositions from the box and the following phrases.

after; before; by; of; on; to; without

alter the size of the sample – increase the temperature

After/before altering the size of the sample, the temperature was increased.

in spite - study hard – not pass the exam

.....

look forward – finish the academic year

.....

the edge of the ski – facilitate turning - cut into the snow

.....

see the new instrument - enter the lab

.....

start the instrument – read the manual first

.....

KEY

- In spite of studying hard, he didn't pass the exam.
- He looked forward to finishing the academic year.
- The edge of the ski facilitates turning by cutting into the snow.
- She saw the new instrument on entering the lab.
- He started the instrument without reading the manual first.

Gerund after Adjectives + Preposition

Task 3. Add the prepositions from the box, some of which will have to be used several times, and change the verbs into the gerund.

about; against; at; for; in; of; on; to; with;

She is good/bad (work) with students.

He is angry (lose) his notebook,

Professor X. is disappointed (see) such a bad report.

The instruments are famous (give) reliable performance.

The company is interested (hire) him.

KEY

- good/bad at working
- angry about losing
- disappointed about seeing
- famous for giving
- interested in hiring

Gerund after Nouns + Preposition

This is the advantage (use) underground cable.

Special clothing protects against the danger (be) exposed to radiation.

KEY

- the advantage of using
- the danger of being exposed

Gerund after Verbs + Preposition

He was accused (plagiarize) from the internet.

The research group concentrates (develop) applications for new composites.

Students have to cope (solve) many problems.

Medical interns have to get used (work) long hours.

They decided (use) non-recyclable materials.

KEY

- accused of plagiarizing
- concentrates on developing
- cope with solving
- get used to working
- decided against using

Gerund after Certain Verbs

Note that certain English verbs require a following gerund.

Lists of such verbs are listed in any English grammar book. Below are a few examples.

Task 4. Use the gerund of the verbs in brackets to form meaningful sentences with the verbs from the box and the following phrases.

admit; avoid; consider; include; justify; suggest

6.4 Case Study: Carbon Fiber Reinforced Polymer (CFRP)

The task (write) an essay.

He had to (pay) that much for the chemical.

Please try to (expose) the sample to light.

We (vary) the temperature and frequency.

She (have, miss) this aspect of the material's failure.

The manual (work) under the exclusion of oxygen.

KEY

- includes writing
- justify paying
- avoid exposing
- considered varying
- admits having missed
- suggests working

**THANK YOU FOR YOUR
ATTENTION**