

Richland High School

Material Science Technology

Syllabus and Introduction

What is Material Science?

Materials science is a multi-disciplinary field involving the properties of matter and its applications to various areas of science and engineering. It includes elements of applied physics and chemistry, as well as chemical, mechanical, civil and electrical engineering.

History

The choice material of a given era is often its defining point: the **stone age**, **bronze age**, and **iron age** are examples. Materials science is one of the oldest forms of engineering and applied science. Modern materials science evolved directly from **metallurgy**, which itself evolved from mining.

Important elements of modern materials science are a product of the space race: the understanding and engineering of the metallic alloys and other materials that went into the construction of space vehicles was one of the enablers of space exploration. Materials science has driven, and been driven by, the development of revolutionary technologies such as plastics, semiconductors, and biomaterials.

Before the 1960s (and in some cases decades after), many *materials science* departments were named *metallurgy* departments, from a 19th and early 20th century emphasis on metals. The field has since broadened to include every class of materials, including: ceramics, polymers, semiconductors, magnetic materials, and biological materials such as medical implants.

Fundamentals of Materials Science

In materials science, rather than haphazardly looking for and discovering materials and exploiting their properties, one instead aims to understand materials fundamentally so that new materials with the desired properties can be created.

The basis of all materials science involves relating the desired properties and relative performance of a material in a certain application to the structure of the atoms and phases in that material through characterization. The major determinants of the structure of a material and thus of its properties are its constituent chemical elements and the way in which it has been processed into its final form. These, taken together and related through the laws of thermodynamics, govern the material's microstructure, and thus its properties. An old adage in materials science says: "materials are like people; it is the defects that make them interesting". The manufacture of a perfect crystal of a material is physically impossible. Instead materials scientists manipulate the defects in crystalline materials

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such as precipitates, grain boundaries, interstitial atoms, vacancies or substitutional atoms, creating a material with the desired properties.

Not all materials have a regular crystal structure. Polymers display varying degrees of crystallinity. Glasses, some ceramics, and many natural materials are amorphous, not possessing any long-range order in their atomic arrangements. These materials are much harder to engineer than crystalline materials. Polymers are a mixed case, and their study commonly combines elements of chemical and statistical thermodynamics to give thermodynamical, rather than mechanical descriptions of physical properties.

Course of study

Quarter One

Introduction to the lab and processes
Introduction to Materials
Scientific Principles
Safety
Tool Usage
Journal keeping

Quarter Two

Mass Production
Individual Projects
Tool Usage

Quarter Three

Bridge Design
Glass and Ceramics
Other Amorphous Materials
Individual Projects

Quarter Four

Polymers
Metal Alloys
Individual Projects

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Curriculum materials

Textbook: Engineering Materials Technology, Jacobs and Kilduff

Professional Journals (printed and online)

Several video segments will be shown throughout the year. Many times these are short pieces of video that show a specific topic or subject.

We will watch the video, Apollo 13, in early November because I will be out of town for a conference. Worksheets will be completed for this video.

Selected Reading assignments

Grading and Evaluation:

This class is graded and evaluated on a point's basis. You will have the ability to earn points based on the quality of your work, **along with effort and participation**. Every day will start with an entry task that takes about 5 minutes. This task is worth 5 points and will be completed as you come into the room. If you are tardy, you may not work on the entry task and will lose the points for that day. They can sometimes be made up after or before school only. Sometimes the entry tasks are group projects and cannot be made up individually. Individual/group labs and assignments are worth points as noted on each assignment.

You will see on the calendar days marked "Student Hand's On Practice". These days are for you to work on individual lab projects, such as glass beads or wood turning. Each project is worth a set number of points, depending on its complexity. Just as importantly, each Project Day is also worth 20 participation points. If you miss one of these days due to an excused absence, you are free to make them up after school and gain full points. If you decide it is more important to use this time to do your math or history homework, you will lose the points and will not be allowed to make them up. You will also lose the time allotted to be working on the really neat tools we have here in the MST lab. Sitting around talking to your friends while they are trying to work will also cost you the participation points. It is entirely my professional judgment regarding your participation points. The easiest way to get full credit is to do full work (*Hey—what a concept!*).

Lab Safety

Because of the nature of the tools and processes we use on a daily basis, you will hear me preach safety every day. Sometimes I will rant and rave about safety. You will get tired of hearing me talk about safety. I don't play around when it comes to safety in the classroom. You will read and follow the safety instructions I hand out to you. You will read and understand the safety rules and instructions. You will be tested on safety procedures on the tools and equipment. I would much rather slow down the class and repeat instructions on a tool, than have you get injured using it.

Remember, you are responsible for your own safety in the MST Lab. You are also responsible for telling me when you discover a machine is not working correctly or a tool breaks.

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Attendance

The school policy on attendance will be followed. Please understand that this is a participatory, hands on class. If you are going to miss a great many days because you are taking a long family vacation during the school year, or just are in the habit of missing as many days as possible right up to the limit, do us both a favor and take another class. While you can make up the days missed for excused absences, you will always be at a disadvantage to the other students because you lose the interaction and help they can provide. Unexcused absences cannot be made up. If you are legitimately ill or there is a family emergency, I am more than willing to work with you to adjust the number of projects due or help in any way I can.

Project payment

I pay for most of the supplies and materials that are used in this class. As many students like to complete a larger, more elaborate project, you are required to pay for those materials. For example, I require everyone to learn how to use the lathe. We turn a small spindle and I pay for that. But, several students last year wanted to make baseball bats. I have blanks available and the students paid for them at the same price I pay. The same goes for all the other projects. I will give you the cost of any items you have to pay for.

Please take this syllabus home and go over it with your parents. Let them know what you are doing in class and invite them to come in anytime to visit. You or your parents can contact me at school anytime between 7:15 and 3:00. My phone number is 967-6535 and my e-mail address is brian.smith@rsd.edu. It is usually much easier to e-mail me because the office will not ring my room unless there is an emergency.

The website for Material Science is now online at the following address:

<http://www.rsd.edu/schools/rhs/mst/>

Thanks for taking Material Science this year. I will work hard to provide you with a great educational experience. You will need to work hard to get the most out of the class.

Brian R. Smith M.Ed
Technology Teacher
Richland High School