



School of Engineering
Materials Science (ENGG*2120)

Project Description
Fall 2018

Overview

Many technological advancements in areas such as communications, biomechanics, sustainable energy, and computing result from material innovations. New materials are being developed to meet the specific properties required for a desired application (e.g. carbon-carbon composites, conductive ceramics) while other materials with unique properties are used in new ways (e.g. carbon nanotubes, shape memory alloys). The aim of ENGG*2120 is to understand the link between the structure and processing of a material and its properties. This includes understanding the microstructure and how it influences material strength, ductility, conductivity as well as other characteristic properties.

Most often, the property requirements for a design are known and an appropriate material is selected. However, in some cases the material is unknown and needs to be identified (e.g. forensics, reverse engineering). The purpose of this project is to identify three (3) unknown materials based on your knowledge of materials science, well reasoned logic, and simply determined, basic material properties (i.e. colour, density, flexibility, conductivity, hardness etc.). Through this project students will have the opportunity to develop experimental techniques, critical thinking and report writing skills.

During this self-directed project, each group of students will be responsible for conducting appropriate tests to determine the identity of each of their given samples. These **non-destructive** tests may involve the use of any apparatus that students can safely operate, ranging from simple visual examination to tests in their own kitchen, or in the materials laboratory. **(You MUST ask a technician or a GTA for assistance before using laboratory equipment!)** The technician and GTAs are here to assist in the safe operation of the lab equipment. For this project, they are not going to tell you what to do. One of the main goals of this project is to develop and execute your own experimental plan.

In completing this project, students should use available resources to identify their 3 specimens. Students should record qualitative and quantitative observations for each specimen. This evidence must be used to write a convincing discussion, explaining how these data lead to a determination of the identity of each specimen. Each group is expected to identify the class of the material (i.e. metal, polymer, ceramic, or composite) and the type of metal, polymer, ceramic, or composite. Students should also describe products that could be manufactured from these materials and then explain why these materials might be chosen for that purpose. The project mark will

rest heavily on the appropriateness (and ingenuity) of the tests, observations and the interpretation of the results (reasoning). The precise identification of the material is not as important as the methodology and reasoning used to identify the material.

Project Report

The project report should be written as a formal engineering report as outlined in the ENGG*2120 Material Science Lab Manual. When writing the report use 11 pt font and 1.5 spacing. **The report must not exceed 15 pages in total** - any additional pages will not be graded. The final report should be organized into sections as follows:

Title Page

1.0 Introduction

2.0 Experimental Apparatus and Procedures

3.0 Material A

3.1 Material Description

3.2 Experimental Procedures

3.3 Results

3.4 Discussion

3.5 Material Identification

4.0 Material B

4.1 Material Description

4.2 Experimental Procedures

4.3 Results

4.4 Discussion

4.5 Material Identification

5.0 Material C

5.1 Material Description

5.2 Experimental Procedures

5.3 Results

5.4 Discussion

5.5 Material Identification

6.0 Conclusions

7.0 References

Report Section Descriptions:

Title Page: The title page should contain the following information:

- University of Guelph
- School of Engineering
- Course number
- Project Title
- Professor's Name
- Group Number and Author Names
- Date

Introduction:

The introduction outlines the purpose the work described in the report. The definition of "the problem", the purpose and the objectives of the project are presented in a clear, concise manner. Some background information is often provided to help the reader understand the purpose and content of the report. For this

project, the introduction should include a brief discussion of the general characteristics of metals, polymers, ceramics, and composites. The introduction should be short.

Experimental Apparatus and Procedures:

This section is used to describe the measurements and experiments used in identifying each of the materials. The description of the experiment should include the equipment used, the type of measurement taken, and how the measurements were taken. A detailed step-by-step procedure is not required, but sufficient detail should be provided in order to assess the feasibility of the experiment. You will refer to this section when describing the experimental procedures used to identify each material. Each test must be non-destructive, that is, the material should not be significantly damaged during testing. For safety reasons, materials should not be heated above 150°C. **Be sure to use equipment safely!** Seek assistance if you are unsure how to operate any equipment.

Material Identification:

For each material include a Material Description, Experimental Procedures, Results, Discussion, and Material Identification section.

Material Description:

The physical features of the material should be stated in this section including the size, shape, and colour of the material. This section should provide enough detail for the reader to determine what material is being examined. (e.g., the round silver piece, the small black square piece, etc.)

Experimental Procedures:

This section states which of the experiments outlined in the Experimental Apparatus and Procedures section were used to identify the material. Briefly describe why each experiment was chosen and how it aids in the identification of the material. That is, what information will the experiment provide to assist in identifying the material?

Results

The results of each experiment should be presented in a neat and organized manner in this section. Any figures or tables should be introduced with a brief sentence or paragraph describing the information contained in the figure or table. Your results section should support any observations and conclusions that can be made based on the data presented.

Discussion

The logic and reasoning used to identify the material based on the experimental results is presented in this section. Clearly and concisely describe how the final material identification was made based on the experimental results and published properties of materials in the textbook and literature. When identifying the material, it is just as important to state why some materials were excluded as it is to state why some materials were included as possible material candidates. If choosing from multiple materials, then state which materials are being considered and the reasons why. A well-reasoned discussion will show consistency between the experiments chosen, the results, and the final material identification using high quality references.

Material Identification

Clearly state the type and class of the now identified material. That is, is the material a metal, polymer, ceramic, or composite? What type of metal, polymer, ceramic, or composite is the unknown material?

Once the material is identified, describe a specific application where that material would be used. What are the specific properties of the material that make it desirable for the stated application?

Conclusions

This section clearly states the important findings from your experiment. These conclusions must be based on results obtained from the experimental results and discussion. The conclusions may also relate to any purposes or hypotheses stated in the introduction. The conclusions section should not introduce new information. It should be short and concise.

References

A list of references used in preparing the project report must be listed in the References section. Using published material is acceptable, but only if you do not attempt to claim this work as your own. If you fail to give credit to your source, it is called plagiarism which is unacceptable and an academic offence! Each reference must be listed in the reference section at the end of the report in the order encountered in the text and should include author, book or paper title, (journal title), publisher, city and date. This ensures that the information you are using is properly credited, reliable and can be verified.

All samples must be returned undamaged. Your lab report will be considered late until the samples are received by the GTA.