

Hazard Analysis
Measuring Microstructure Changes During
Thermal Treatment

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Table 1: Revision History

Date	Developer(s)	Change
Oct 13, 2022	Abdul Nour Seddiki	Integrated the Template + Added System Boundaries and Components
Oct 14, 2022	Edwin Do	Add introduction, scope and purpose of HA
Oct 19, 2022	Joseph Braun	Added FMEA Table
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1 Introduction

This document is the hazard analysis for Team 30 (ReSprint) Capstone project. This project collaborates with the Department of Materials Engineering to measure the microstructure changes of samples during thermal treatment.

For this document, a hazard will be defined as a scenario where the conditions of a system and environment constitutes the potential of harm to someone or something.

2 Scope and Purpose of Hazard Analysis

The purpose of this hazard analysis is to document any potential unsafe behaviour in this project. This includes risks in this project that can arise from using either the software or hardware components. For each hazard identified, this document will outline one or more methods to help mitigate the hazard.

The scope will be limited to identifying the possible hazards from the system's components, methods of mitigation, potential causes, and any resulting security or safety requirements.

3 System Boundaries and Components

This hazard analysis is conducted on the system that consists of the following components:

1. Thermally treated samples
2. The current source
3. A thermometer
4. The nano-voltmeter
5. Interfaces between above devices and control computer
6. The control computer
7. The software application that will be installed on the control computer

These components comprise the system in question. And they each are also considered the boundaries for this system. Some of the components mentioned are not controllable by ReSprint team, such as the thermally treated samples and all of the measurement devices and hardware including the current source, the thermometer, the nano-voltmeter, the communication interfaces and the control computer. Therefore, the only component controllable by ReSprint team is the software application and its sub-systems.

4 Critical Assumptions

[These assumptions that are made about the software or system. You should minimize the number of assumptions that remove potential hazards. For instance, you could assume a part will never fail, but it is generally better to include this potential failure mode. —SS]

5 Failure Mode and Effect Analysis

Table 2: FMEA Table

Component	Failure Mode	Effects of Failure	Causes of Failure	Recommended Action	Req.	Ref.
Current Source	Current source does not provide current	Nanovoltmeter cannot measure voltage across sample	a. Setup error b. Hardware failure	a. Troubleshoot current source setup b. Replace current source	a. HWR1 b. HWR2	H1-1
Nanovoltmeter	Nanovoltmeter does not read voltage across sample	Voltage data cannot be communicated to App	a. Setup error b. Hardware failure	a. Troubleshoot nanovoltmeter b. Replace nanovoltmeter	a. HWR1 b. HWR2	H1-2
Temperature Sensor	Temperature sensor does not read temperature of the sample	Temperature data cannot be communicated to App	a. Setup error b. Hardware failure	a. Troubleshoot temperature sensor setup b. Replace temperature sensor	a. HWR1 b. HWR2	H1-3
Serial Connection	App does not receive data from hardware	Data cannot be communicated to App	a. Setup error b. Hardware failure	a. Troubleshoot serial connection b. Replace serial connection cable	a. HWR1 b. HWR2	H1-4
Windows App	App cannot be installed on lab computer	User cannot utilise the App	a. Compatibility error	a. App shall be designed to be compatible with the operating system on the lab computer	a. SWR1	H2
	App is not ergonomic for user	User cannot utilise the App without causing harm	a. Graphics change brightness too rapidly b. Graphics contain colours that are too bright	a. App shall not change screen brightness unless the user chooses b. Graphics shall be designed with dimmed or neutral colours	a. SFR1 b. SFR2	H3

Table 3: FMEA Table continued

Component	Failure Mode	Effects of Failure	Causes of Failure	Recommended Action	Req.	Ref.
Windows App	App does not receive data	Resistivity of sample cannot be calculated	a. Setup error b. Hardware failure c. Software connection error	a. Refer to H1 b. Refer to H1 c. Check that software is accessing the correct serial port	a. HWR1 b. HWR2 c. SWR2	H4
	Calculated values are not correct	User receives inaccurate results	a. User altered measurements through interface b. Software does not calculate values correctly	a. Prevent user from altering measurements received from hardware b. Check that formulas for calculation used by software are correct	a. SCR1 b. SWR3	H5
User	User sustains physical injury while interacting with hardware components	User cannot utilise the App; Legal ramifications	a. User is not trained to interact with hardware components	a. Ensure that authorised users are properly trained to interact with hardware components safely	a. SFR3	H6
	App is modified by unauthorised user	App no longer functions as required	a. Unauthorised user has gained access to App	a. Ensure that only authorised users are permitted to access the App	a. SCR2	H7

6 Safety and Security Requirements

[Newly discovered requirements. These should also be added to the SRS. (A rationale design process how and why to fake it.) —SS]

7 Roadmap

[Which safety requirements will be implemented as part of the capstone timeline? Which requirements will be implemented in the future? —SS]