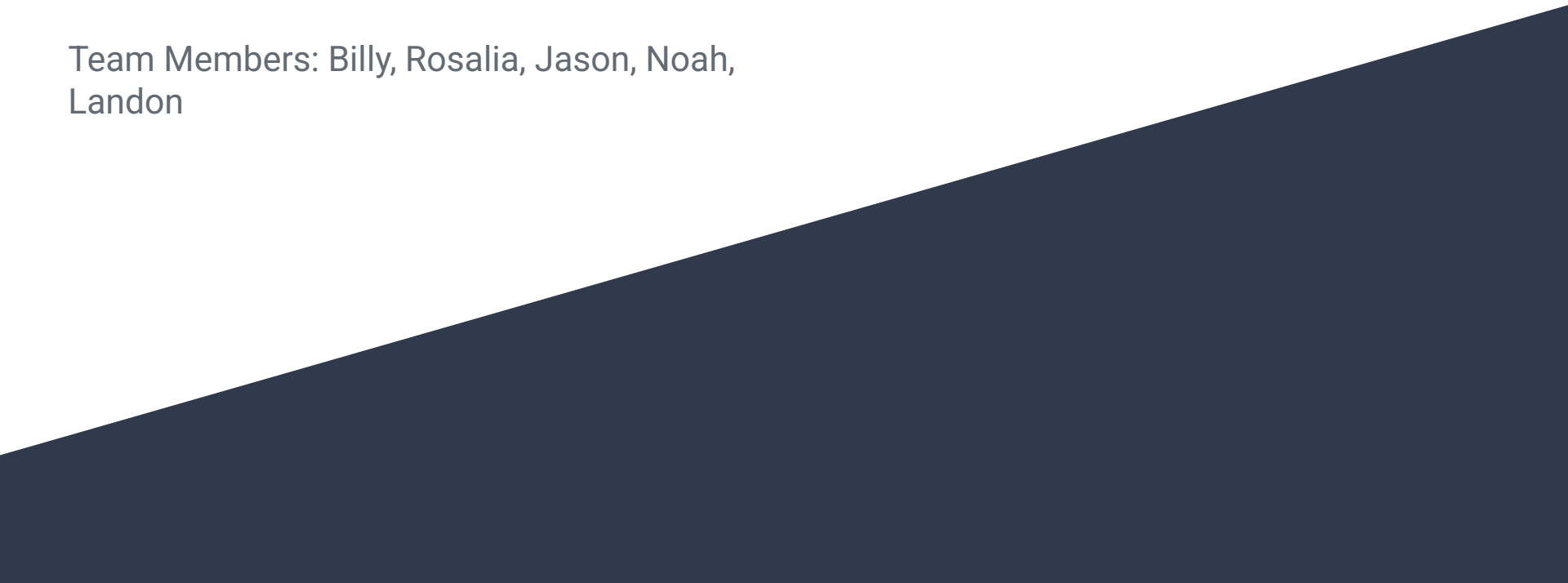
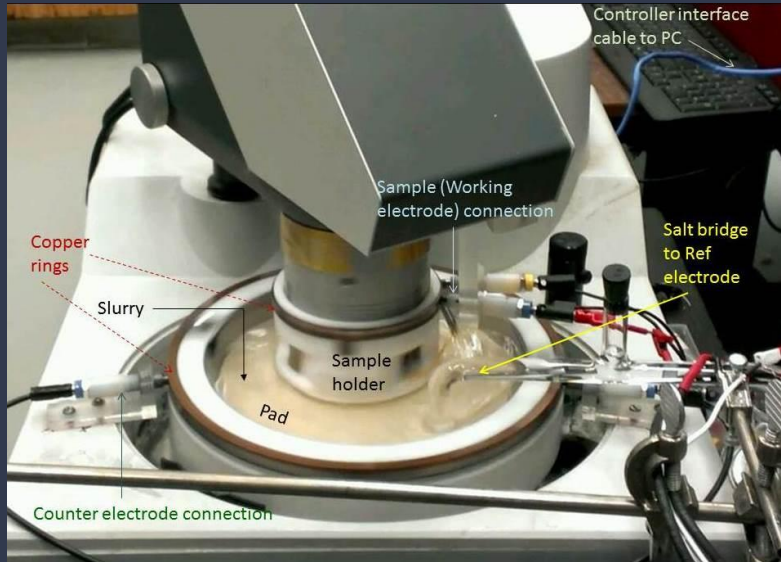


CMP Slurry

Team Members: Billy, Rosalia, Jason, Noah,
Landon

A dark blue diagonal gradient bar that starts from the bottom left and extends towards the top right, covering the lower half of the slide.

Background Info



What is CMP?

CMP stands for chemical mechanical planarization. CMP utilizes mechanical and chemical procedures to polish wafers which create smooth and planar surfaces on materials. It is primarily used in semiconductor manufacturing for such as circuits and chips.

Why is it important?

It is important because CMP enables the creation of complex and highly functional microchips.

Objective

Process Information

Process Step: **Hydrothermal** 1 < Enter Process Name

Input Materials

1.1 Precursor Materials (Click here add additional chemicals)

2 Choose from known precursors from library 3 Enter Amount of Precursor Used in this process

Precursor Chemical 1: **Chemical Name** **Chemical Formula** **Quantity (kg)** **Final Chemical Formula** **Isotomeric Ratio (Final:Initial)** **Precursor Product**

Precursor Chemical 2: **Chemical Name** **Chemical Formula** **Quantity (kg)** **Final Chemical Formula** **Isotomeric Ratio (Final:Initial)** **Precursor Product**

1.2 Solvents

4 Choose Solvent 5 Enter Solvent

Solvent 1: **Chemical Name** **Chemical Formula** **Quantity (kg)** **Final Chemical Formula** **Isotomeric Ratio (Final:Initial)** **Solvent Product**

Solvent 2: **Chemical Name** **Chemical Formula** **Quantity (kg)** **Final Chemical Formula** **Isotomeric Ratio (Final:Initial)** **Solvent Product**

1.3 Water

6 Choose Type 7 Enter Quantity

Purification Type **Quantity (L)** **Water Production (kgCO₂/L)** **Total CO₂**

Water used for reaction **Quantity (L)** **Water Production (kgCO₂/L)** **Total CO₂**

Cleaning/Washing Particle **Quantity (L)** **Water Production (kgCO₂/L)** **Total CO₂**

Tool Washing water **Quantity (L)** **Water Production (kgCO₂/L)** **Total CO₂**

Process Time Information

8 Replace with your Process Time 9 Enter additional time information

Process Time (h): **6.19** Average process time for selected process obtained from literature

Typical Process Time Range (h): **Active Process Time (h)** **Time Basis** **Warmup Time (h)** **Tool Idle Time (h)**

Equipment Power Information

10 Replace with your Power Rating information

Power Rating (kW): **7.62** 7.62 kWh/kg Value obtained based on literature

Site Power Consumption (kWh): **7.62**

Efficiency (%): **7.62**

Typical Power Active Consumption (kW): **7.62**

What we're trying to achieve in this project?

Our goal is to transform an Excel-based analysis into an interactive and user friendly web application. By utilizing data collected by Clarkson faculty members, we aim to make this accessible to a wider audience, enabling researchers, engineers, and industry professionals to make informed decisions regarding CMP slurry manufacturing.

1 Enter your process values to compare against values in literature

Selected Process Name

| Hydrothermal | Min | Max |
|---------------------|-------|-------|
| Average | | |
| Power Rating(kW)/kg | 7.62 | 112.5 |
| Utilized Volume(L): | 81.23 | 800 |
| Process time(h): | 6.19 | 20 |

Note: Utilized volume is 80% of the total volume of the equipment

Your tool power rating(kW)

1.56 2

Enter your tool power rating to check range

Your Process time
Average energy consumption(kWh):
Your process energy consumption(kWh):

2
47.17
3.12 3

Calculated based on process time and tool power rating(kW)

Missing process?

[Click here to add your process into database](#)

Ravitej Venkataswamy [1], Andrew McDonald [2], Andrew Carswell [2], Douglas Nevers[3], Alan Rossner [4] and Jihoon Seo [1*]

[1] Department of Chemical & Biomolecular Engineering, Clarkson University, Potsdam, NY, USA

[2] DRAM CMP, Micron Technology Inc, Boise, ID, USA

[3] NAND CMP, Micron Technology Inc, Boise, ID, USA

[4] Institute for a Sustainable Environment, Clarkson University, Potsdam, NY, USA

Objective

Start Process

Process Information

Precursor Synthesis ▾

Input Materials

1.1 Precursor Materials

| | Chemical Name | Chemical Formula | Quantity(kg) |
|-----------------------|----------------------|----------------------|----------------------|
| Precursor Chemical 1: | <input type="text"/> | <input type="text"/> | <input type="text"/> |
| Precursor Chemical 2: | <input type="text"/> | <input type="text"/> | <input type="text"/> |

1.2 Solvents

| | Choose Solvent | Enter Solvent (Quantity(L or Kg)) |
|------------|----------------------|-----------------------------------|
| Solvent 1: | <input type="text"/> | <input type="text"/> |
| Solvent 2: | <input type="text"/> | <input type="text"/> |

1.3 Water

| | Calcination | 12 | 12 | 16 | 38 L | 1200° C |
|-------------|-------------|----|----|-------|---------|---------|
| Calcination | 16 | 16 | 22 | 92 L | 1200° C | |
| Calcination | 12 | 12 | 12 | 28 L | 1200° C | |
| Calcination | 24 | 24 | 24 | 227 L | 1200° C | |
| Calcination | | | | 2 L | 1150° C | |

Required Information

Before filling the form, keep the 'required' information ready for each process

| Section | Category | Parameter | Required Details |
|---------|-----------|------------------------|--------------------------------------|
| | Materials | Chemical Names | Precursor materials and Solvents |
| | | Quantities | Each chemical (kg) |
| | | Water Consumption | Total amount of water used per batch |
| | Power | Power Rating | kW |
| | | Idle Power Consumption | kWh |
| | | Efficiency | Percentage (%) |
| | | Active Power | Percent Usage |

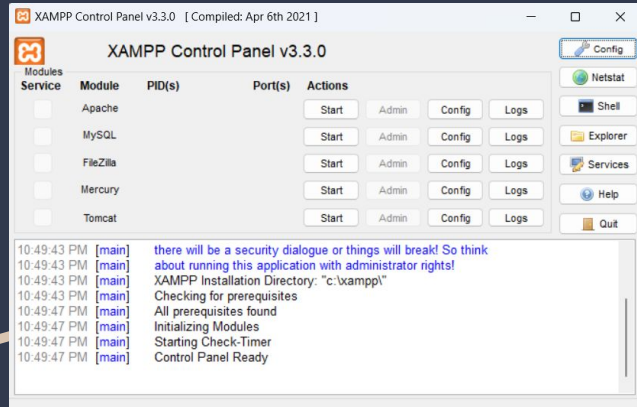
| Chamber Size W(inch) | Chamber Size D(inch) | Volume(L) | Operating Temperature |
|----------------------|----------------------|-----------|-----------------------|
| 6 | 6 | 4 L | 1200° C |
| 6 | 8 | 5 L | 1200° C |
| 7 | 8 | 6 L | 1200° C |
| 8 | 12 | 11 L | 1200° C |
| 10 | 16 | 26 L | 1200° C |

What are the success criteria? Plan?

We made three plans:

- Plan A:
 - An open source website that anyone could have access to, this would be the most useful for accessibility for research.
- Plan B:
 - An app you could download from Github or partial functionality of the website. This would allow for partial use as well as accessibility.
- Plan C:
 - An accessible script.

Implementation



During the implementation phase of the website, we based the design and layout of it on the design diagrams and graphs which we created.

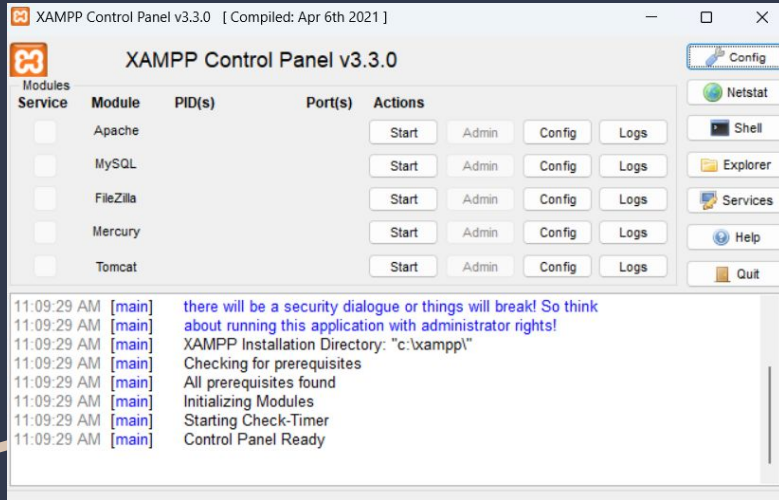
- Software used
 - Html/css
 - Javascript
 - Php
 - Sql
 - XAMPP/APACHE

XAMPP

Apache distribution

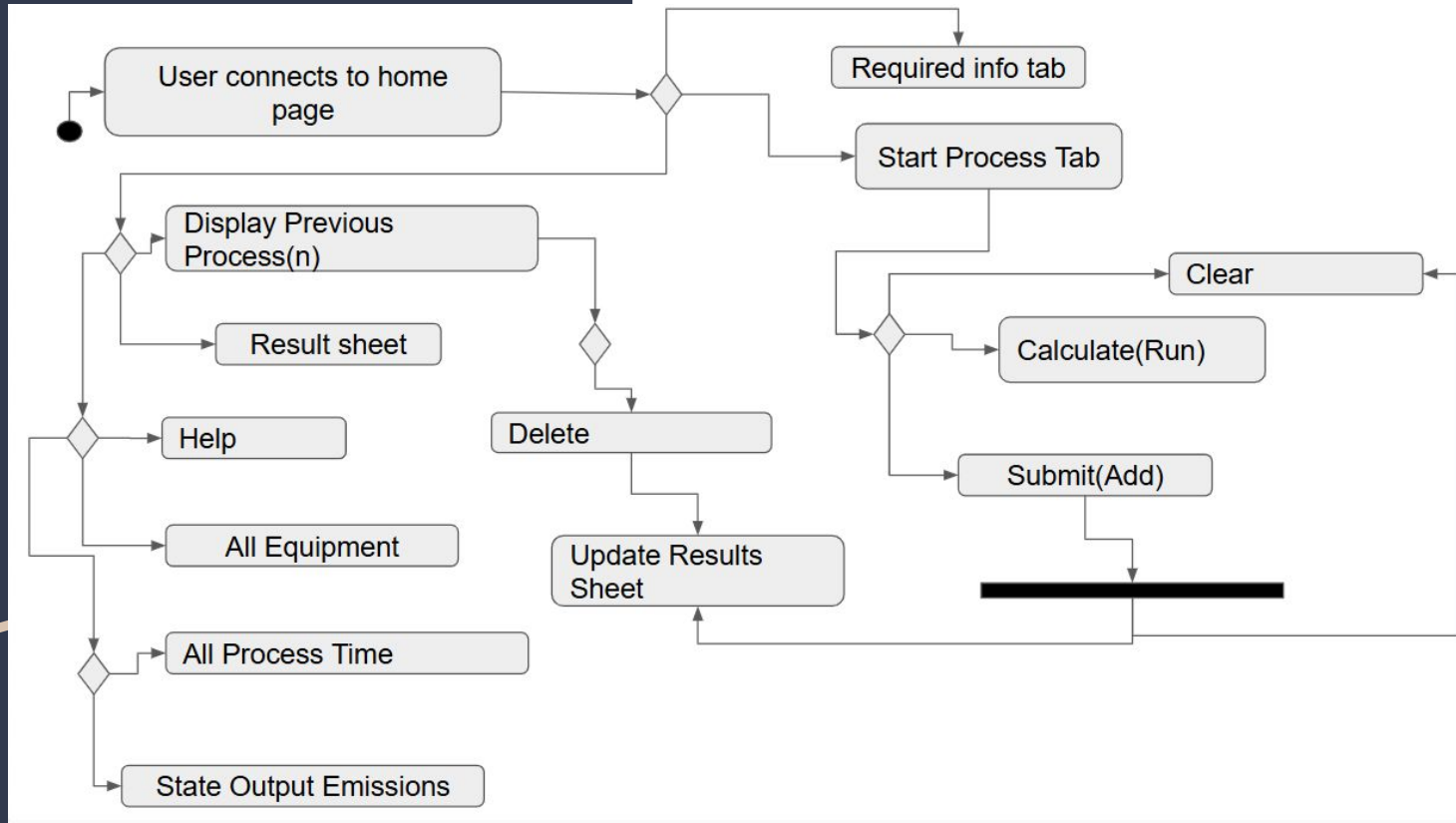


- Allowed us to create and test the website locally on our computer
- Allowed for the use of a database
- To run our website locally
 - Apache
 - MySQL



Show demonstration of website.

UML Diagram



Example Format of Site

| Required Info. | | | | | | | | | | | | | | | | | | | | | |
|-----------------------|---|--------------------|---------------|------------------------|-------------------------------------|---------------------------------|---|--------------------|---------------|------------------------|-------------------------------------|---------------------------------|---|-----------------------|---------------------------------|---------|---------|---------|---------|--|--|
| Start Process | <div>< Start</div> | | | | | | | | | | | | | | | | | | | | |
| Process Name(n) | <div>Process Information</div> <div>Process Step: Hydrothermal < Enter Process Name</div> | | | | | | | | | | | | | | | | | | | | |
| Result Sheet | <div>Input Materials</div> <div>1.1 Precursor Materials (Click here add additional chemicals)</div> <div> <div> <div>2 Choose from known precursors from drop down menu</div> <div>3 Enter Amount of Precursor Used in this process</div> </div> <table border="1"> <thead> <tr> <th>Precursor Chemical 1:</th> <th>Chemical Name</th> <th>Chemical Formula</th> <th>Quantity (kg)</th> <th>Final Chemical formula</th> <th>Stoichiometric Ratio(Final:initial)</th> <th>Maximum Obtainable Product (Kg)</th> <th>Theoretical Amount of Product obtained is calculated based on Molar mass and ratios</th> </tr> </thead> <tbody> <tr> <td>Precursor Chemical 2:</td> <td>Cerium(III) nitrate hexahydrate</td> <td>#ERROR!</td> <td>#ERROR!</td> <td>#ERROR!</td> <td>#ERROR!</td> <td></td> <td></td> </tr> </tbody> </table> </div> | | | | | Precursor Chemical 1: | Chemical Name | Chemical Formula | Quantity (kg) | Final Chemical formula | Stoichiometric Ratio(Final:initial) | Maximum Obtainable Product (Kg) | Theoretical Amount of Product obtained is calculated based on Molar mass and ratios | Precursor Chemical 2: | Cerium(III) nitrate hexahydrate | #ERROR! | #ERROR! | #ERROR! | #ERROR! | | |
| Precursor Chemical 1: | Chemical Name | Chemical Formula | Quantity (kg) | Final Chemical formula | Stoichiometric Ratio(Final:initial) | Maximum Obtainable Product (Kg) | Theoretical Amount of Product obtained is calculated based on Molar mass and ratios | | | | | | | | | | | | | | |
| Precursor Chemical 2: | Cerium(III) nitrate hexahydrate | #ERROR! | #ERROR! | #ERROR! | #ERROR! | | | | | | | | | | | | | | | | |
| Help | | | | | | | | | | | | | | | | | | | | | |
| All Equipment | | | | | | | | | | | | | | | | | | | | | |
| All Process Time | <div>1.2 Solvents</div> <div> <div>4 Choose Solvent</div> <div>5 Enter Solvent</div> </div> <table border="1"> <thead> <tr> <th>Solvent 1:</th> <th>Solvent 2:</th> <th>Quantity (L or Kg)</th> </tr> </thead> <tbody> <tr> <td></td> <td></td> <td></td> </tr> </tbody> </table> | | | | | Solvent 1: | Solvent 2: | Quantity (L or Kg) | | | | | | | | | | | | | |
| Solvent 1: | Solvent 2: | Quantity (L or Kg) | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | |

Questions?