

## Student Worksheet

### *Resist-ance is Useful*

#### Safety

Wear safety glasses, protective gloves, and lab coats. Electrolyte solution may cause mild skin and eye irritation. Spills should be wiped up with plenty of water. Etching for longer than 10 seconds will overheat discs. Use tweezers to pick up heated discs.

#### Introduction

#### Part 2: To AC or not to AC?

You probably know that electricity can be in two forms: direct current (DC) or alternating current (AC). You are going to try electrochemical etching with both and observe the difference.

#### Materials

- Etch-O-Matic etching unit
- 30 mm metal disc
- electrolyte solution
- DC etching adapter
- grounding plate
- timer
- rinsing water
- petri dish
- tweezers
- paper towel
- steel wool

#### Question

**What do you think your final pattern will look like on the metal disc?**

#### Make a Prediction

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#### Procedure

1. Clean your metal disc with water and a paper towel. If necessary, use steel wool to shine the metal disc.
2. Arrange your pattern (mask) on top of your clean metal piece and place both on top of the metal grounding plate.
3. Get a petri dish and fill half full with water. This will be used for rinsing.
4. Attach the white clip (AC) to the metal plate and put a few drops of electrolyte on top of the white parts of your pattern.
5. Put 5 drops of electrolyte on the center of the white felt pad of the etcher.

6. Make sure the etcher is plugged in. Firmly press the etcher down onto your pattern for 10 seconds (etching for longer than 10 seconds will overheat the disc).
7. Remove the etcher and use tweezers to pickup your film and metal disc. Rinse them with water and dry them with a paper towel.
8. Turn the metal piece over and place the metal piece down so that the pattern faces down on the grounding plate. Put your pattern (mask) on top of the metal disc.
9. Attach the white clip to the metal ring on the red DC adaptor clip and attach the red clip to the metal plate.
10. Put a few drops of electrolyte on your pattern and five drops on the pad of the etcher.
11. Make sure the etcher is plugged in. Firmly press the etcher onto your pattern for 10 seconds.
12. Remove the etcher. Rinse your pattern and metal with water and dry them with a paper towel.

### Record Your Observations

1. Observations of etch with white clip:

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2. Observations of etch with red clip:

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### Analyze the Results

1. The red adapter clip changes the etcher output from alternating current (AC) to direct current (DC). How did it change the result?

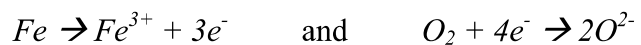
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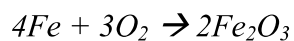
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2. The brown oxide pattern is formed according to the reactions:



The overall reaction is:



Why does the alternating current allow this to happen when the direct current doesn't?

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### Draw Conclusions

Use your prediction, observations and analysis of the results to sum up this activity.

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