**Extraction of Silver via Electrowinning for Solar Panel Recycling**  
Cooper Tezak, chemical engineering  
Mentor: Dr. Meng Tao  
SEMTE

**Purpose**  
Develop an electrochemical process for recovering silver from end-of-life solar modules. Specifically, find the ideal conditions for the electrowinning of dissolved silver from an HF solution.

**Varied Voltage Trials**

<table>
<thead>
<tr>
<th>Voltage (V)</th>
<th>% Mass Recovery</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.6</td>
<td>89.15%</td>
</tr>
<tr>
<td>0.65</td>
<td>98.78%</td>
</tr>
<tr>
<td>0.7</td>
<td>96.36%</td>
</tr>
<tr>
<td>0.75</td>
<td>86.62%</td>
</tr>
<tr>
<td>0.8</td>
<td>78.58%</td>
</tr>
</tbody>
</table>

0.7V appears to be the optimal voltage for mass recovery and product purity.

**SEM Morphology**

**Chronoamperometry**

0.7V appears to be the optimal voltage for mass recovery and product purity.

**Current should approach zero as silver is extracted from the solution, however under experimental conditions the current remains constant at the max value. A possible parasitic reaction is taking place at the cathode:**

\[
O_2(g) + 2H^+ + 2e^- \rightleftharpoons H_2O_2
\]

**Conclusion**  
The experimental setup is insufficient for controlling environmental factors that affect the reaction significantly. Corrosion at the vapor-liquid interface at the working electrode prevents the experiment from running for more than 20 hours without failing prematurely.

**Future Research**

A Nitrogen purge environment will eliminate all parasitic oxygen reactions and allow for a higher current efficiency. Trials need to be conducted at varying voltages and times to determine the best conditions under nitrogen purge.

**References**


Meng Tao. Lecture. School of Electrical Computer and Energy Engineering. 2020