Scanning Electrochemical Microscopy (SECM)

Your Name

Your Institution

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Introduction

Hello everyone! Today I'm going to introduce you to Scanning Electrochemical Microscopy, or SECM - a powerful technique that allows us to create images of catalytic activity at surfaces.

This technique combines principles from:

- Electrochemistry
- Catalysis
- Imaging

Understanding Imaging

- An image is essentially a matrix of numbers
- Each number represents a measurement at a specific point
- In our case, these numbers will represent electrochemical signals
- Just like how a SEM builds an image point by point using electrons, SECM builds an image using electrochemical signals

Catalysis Principles

As demonstrated in our animation:

- Without a catalyst, reactions proceed slowly
- With a catalyst, the same reaction happens much faster
- The catalyst itself remains unchanged

The Challenge:
When we have a catalytic surface, the products diffuse away in all directions. How can we measure where and how active the catalyst is?

Electrochemistry Fundamentals

Electrochemical detection works through simple principles:

- When chemicals react at an electrode surface, they produce electrical signals
- These signals are proportional to the concentration of the reacting species
- The higher the concentration, the stronger the signal

SECM Working Principle

1. We have a detection electrode scanning above a surface
2. When it passes over active catalytic areas:
   - It detects the products being formed
   - The signal increases
   - This creates a peak in our measurement
3. By scanning systematically:
   - We collect signals point by point
   - These build up into a 2D image
   - The image reveals where catalytic activity is highest

SECM Visualization

Our visualization shows four key panels:

- The 3D perspective of the scanning process
- The side view of electrode movement
- The real-time signal response
- The resulting 2D activity map

Conclusion

SECM provides a unique way to 'see' chemical reactivity:

- Combines electrochemistry, catalysis, and imaging principles
- Maps out catalyst activity distribution
- Helps design better materials for:
  - Fuel cells
  - Chemical synthesis
  - And more...