

Understanding Metal Sulfide Growth using ESI FT-ICR MS



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Significance

Making Clusters

Gas Phase Results

Moving Forward

Significance



- **Environmental**
 - George Luther: College of Marine Studies
 - Metals in Aquatic Environments
 - ✦ Bioavailability
 - Hydrothermal Vents
- **Materials**
 - Solar Power
 - ✦ CdS



Making Clusters

7T Bruker Apex Qe
FT-ICR MS

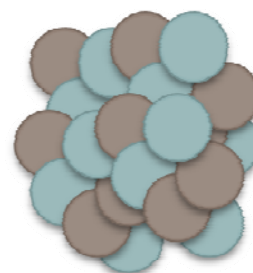
Dissolved Ions



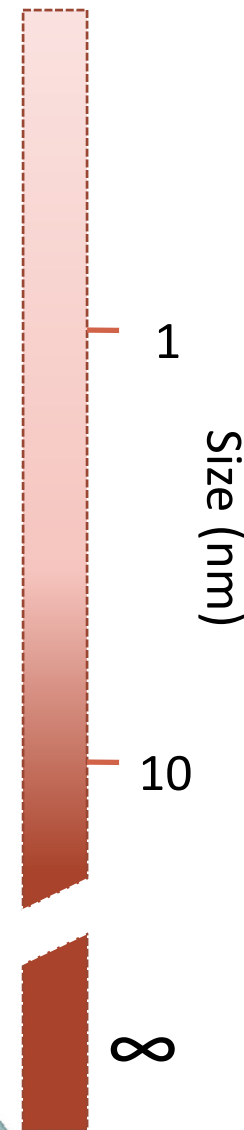
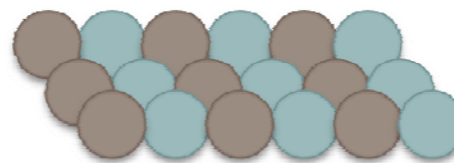
Clusters



Nanoparticles



Solid state material



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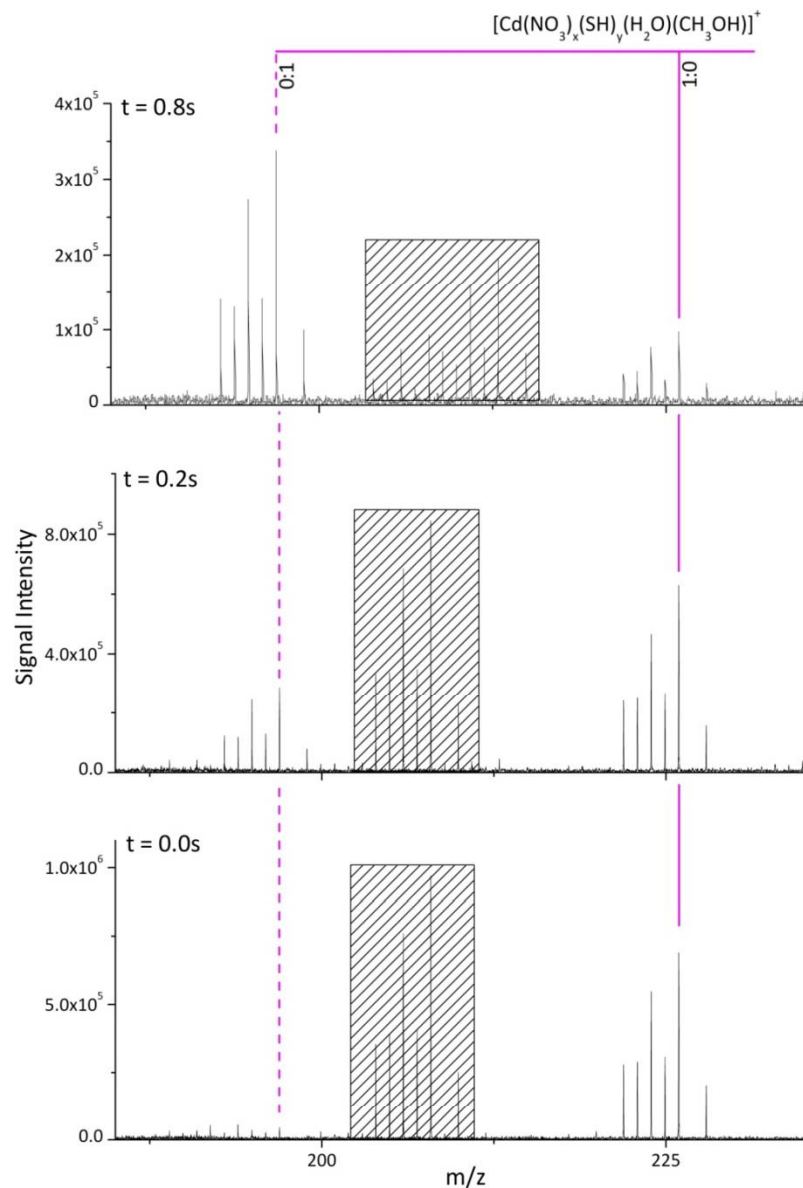
Raw Data



0.5 mM $\text{Cd}(\text{NO}_3)_2 \cdot 4(\text{H}_2\text{O})$

1:1 water/MeOH

4×10^{-9} torr $\text{H}_2\text{S}(\text{g})$



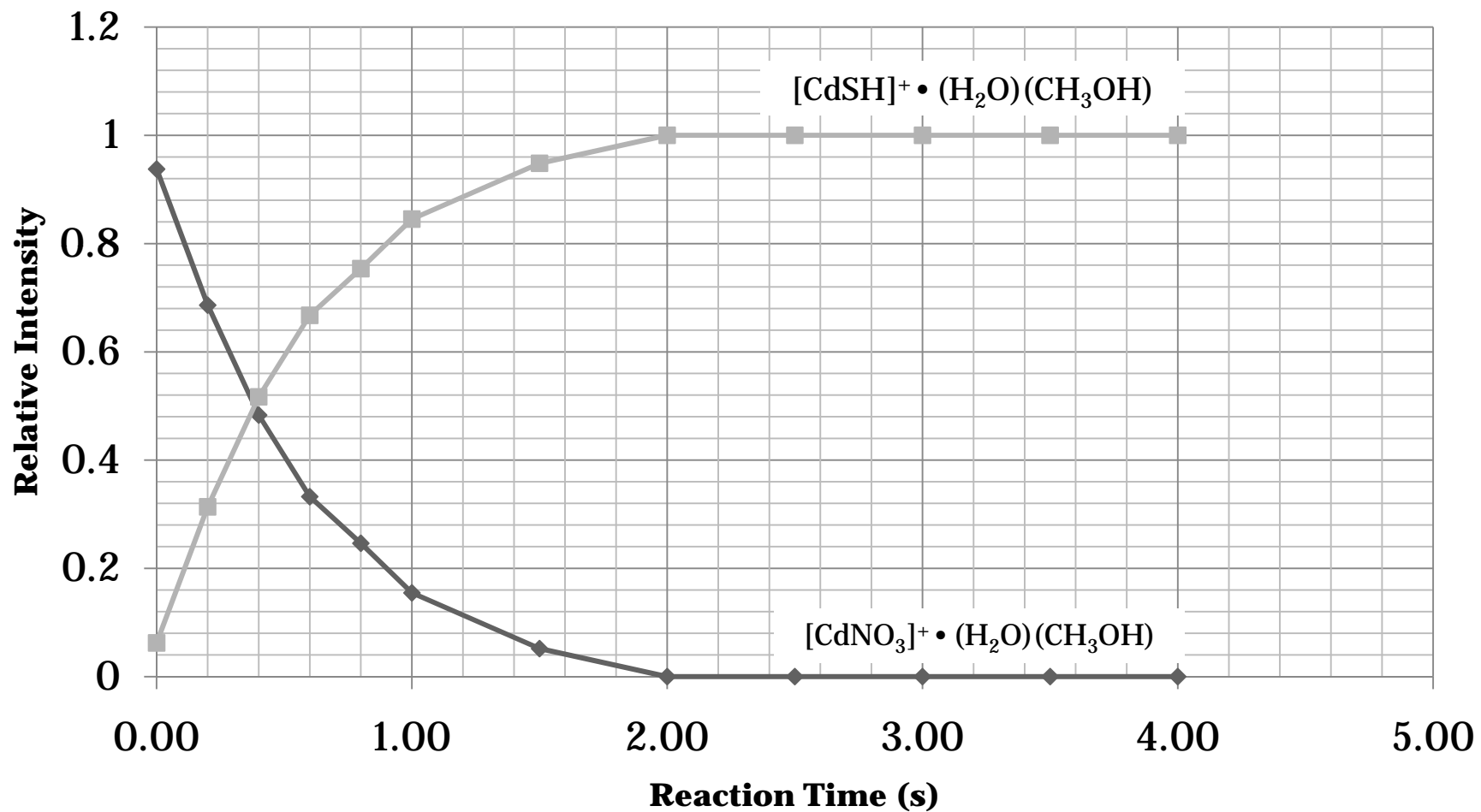
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Reaction Kinetics



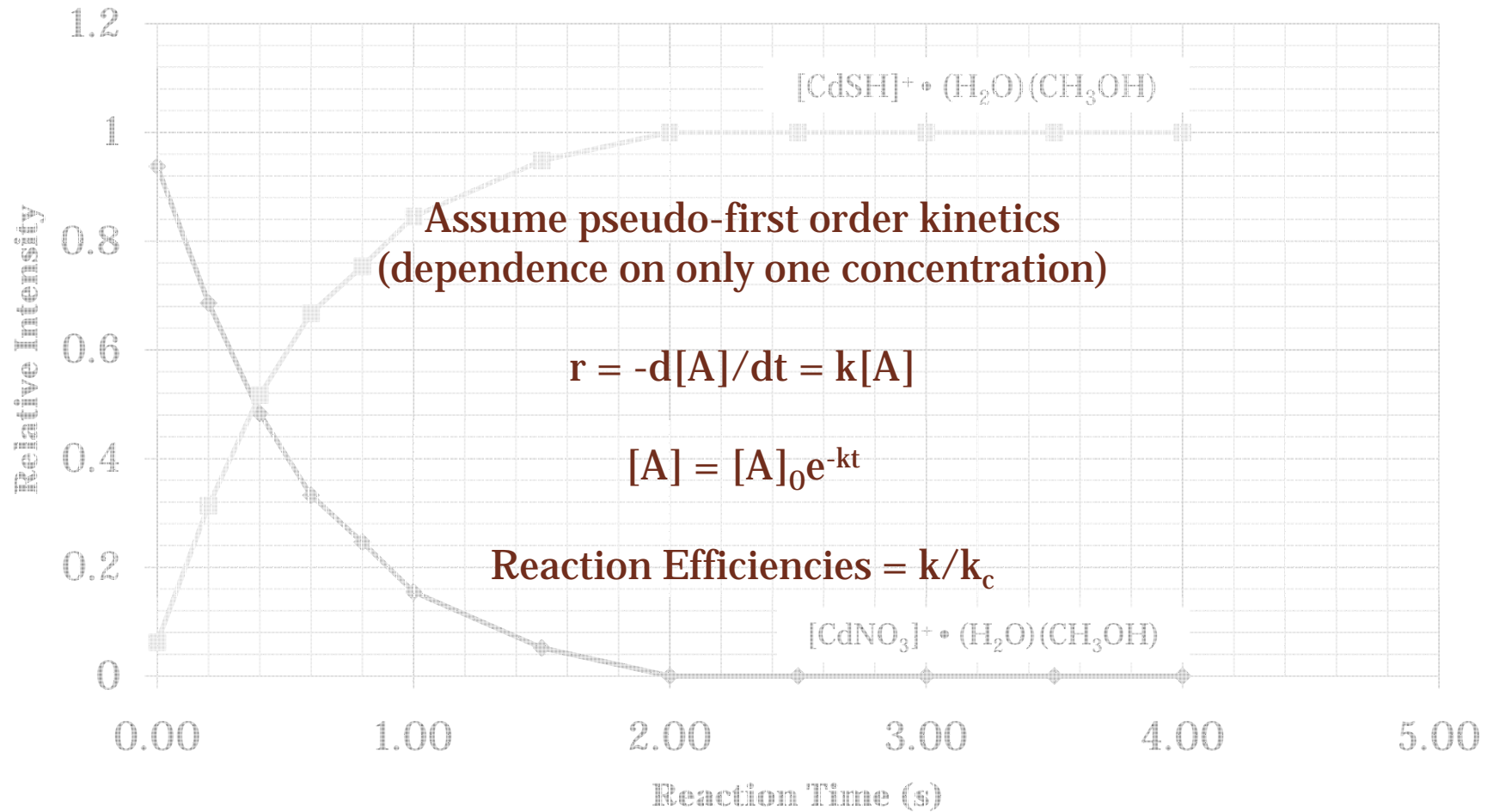
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Anions

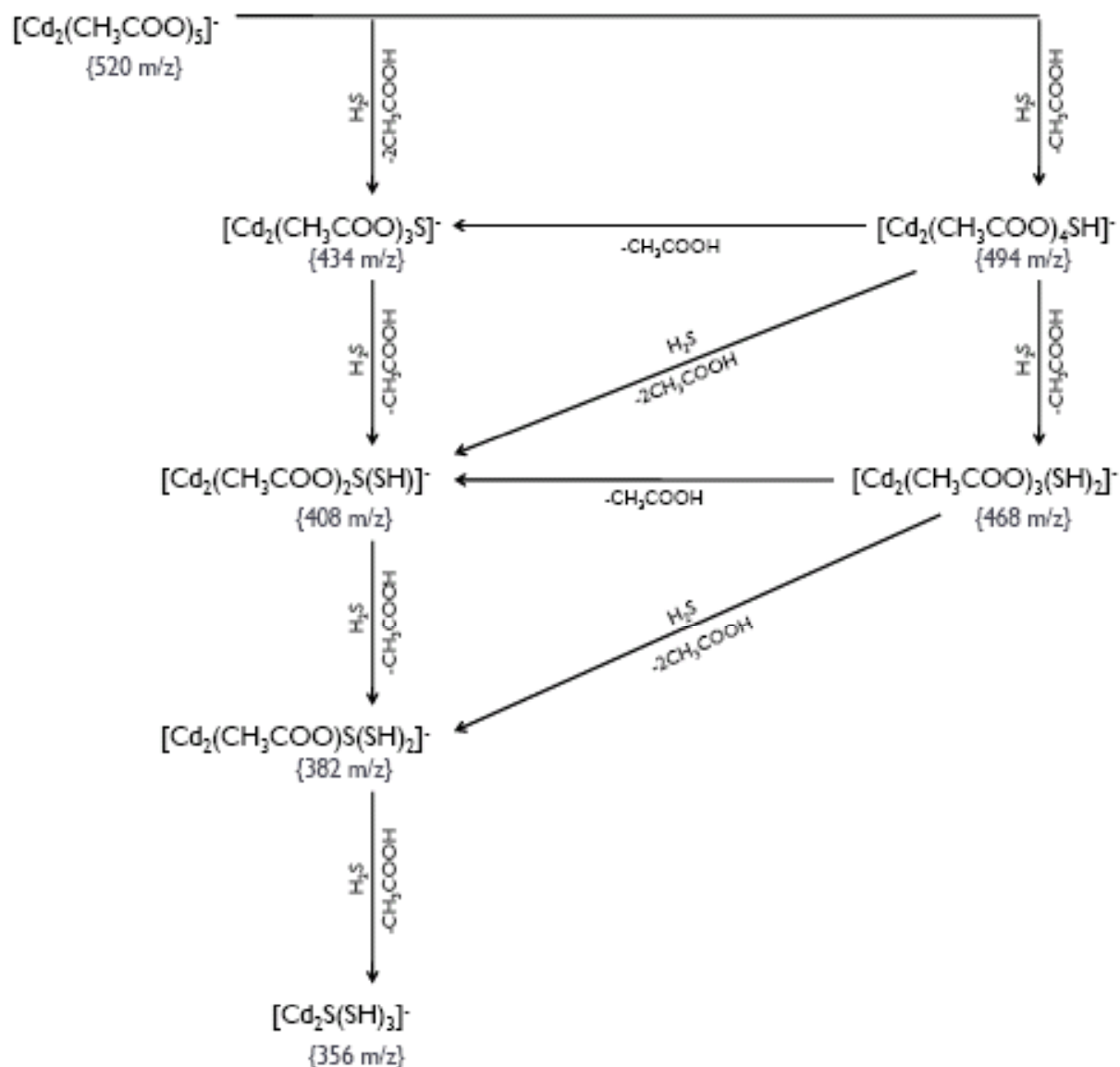
0.5 mM $\text{Cd}(\text{CH}_3\text{COO})_2 \cdot 4(\text{H}_2\text{O})$

0.5 mM $\text{Cd}(\text{NO}_3)_2 \cdot 4(\text{H}_2\text{O})$

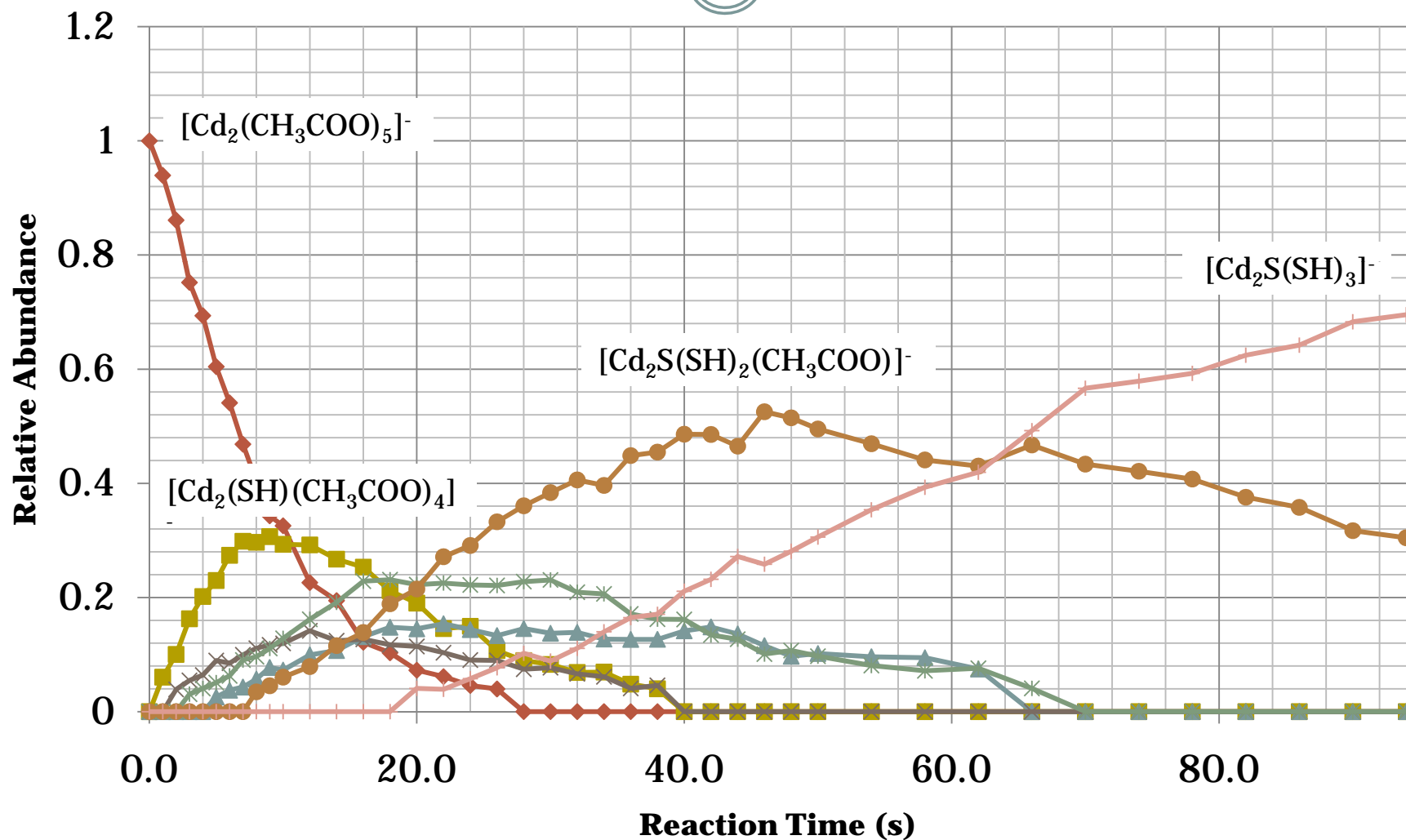
0.5 mM $\text{CdCl}_2 \cdot 4(\text{H}_2\text{O})$

1:1 water/MeOH

9×10^{-9} torr $\text{H}_2\text{S}(\text{g})$



Reaction Kinetics



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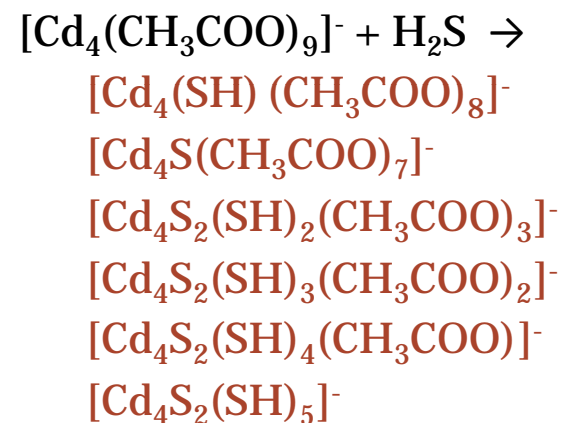
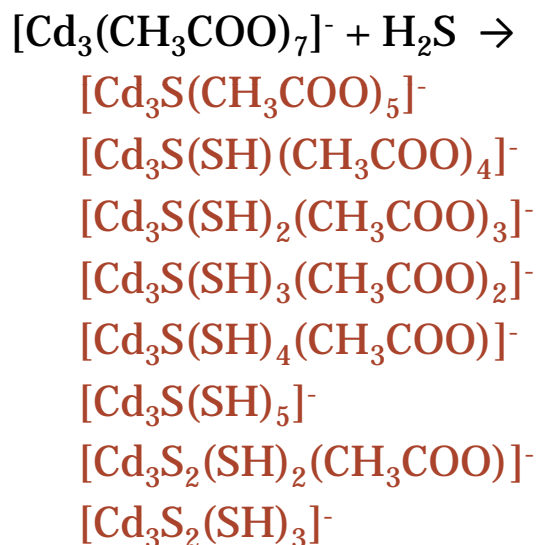
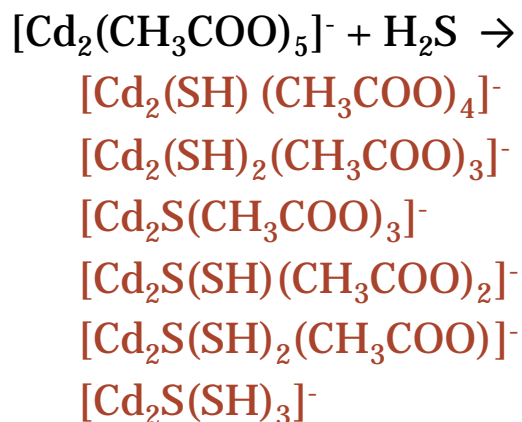
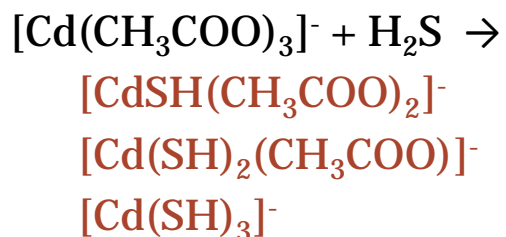
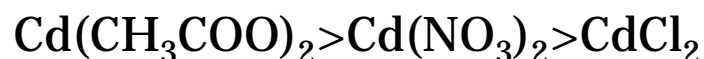
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Gas Phase Results

H_2S reactions with solvated CdNO_3 cations show solvent molecules to be spectators.

Reactivity varies with cadmium salt anion.

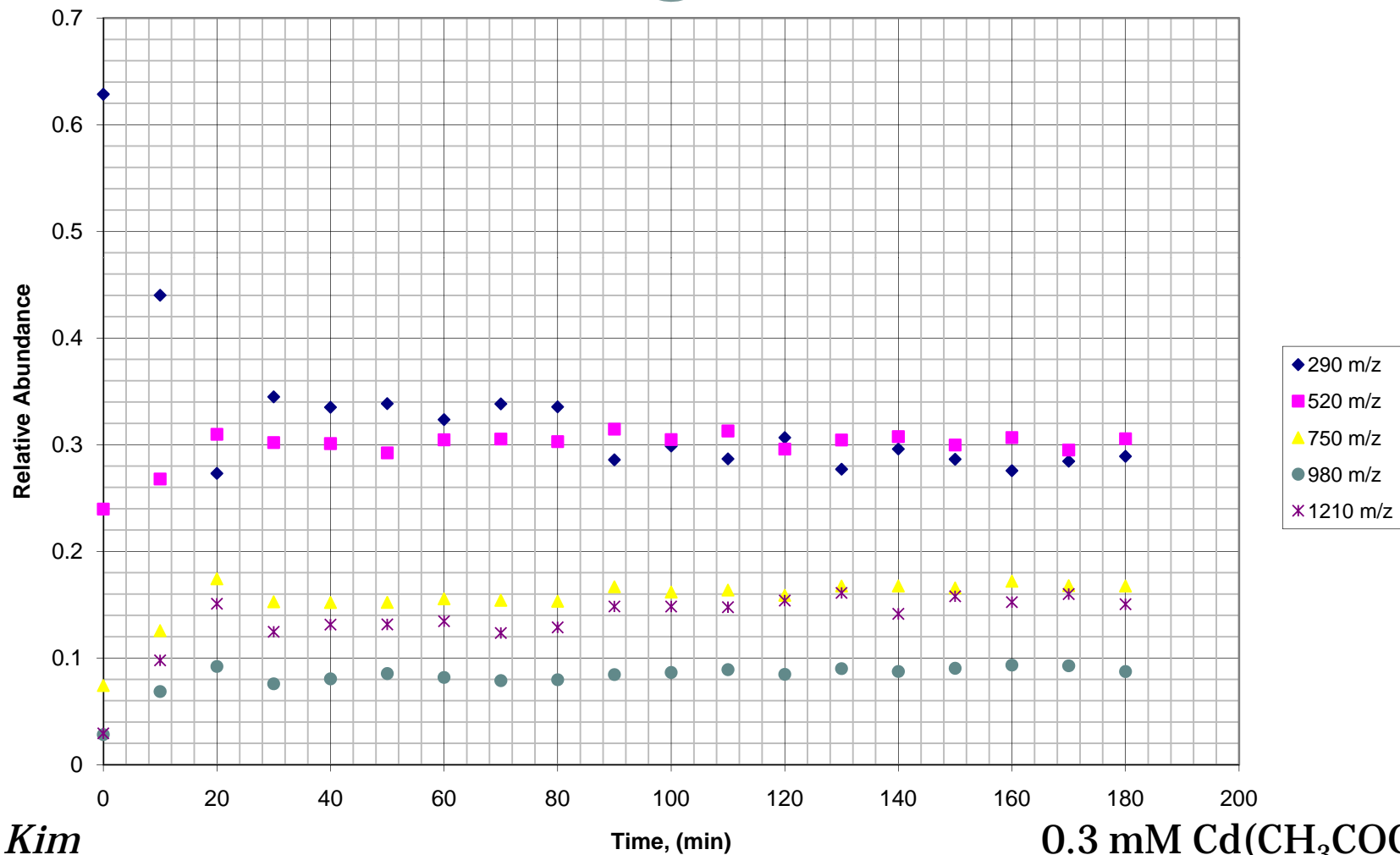


The Next Step



- **High Pressure**
 - $\text{Cd}(\text{NO}_3)_2$
 - CdCl_2
- **CID Experiments**
- **Other Metals**
 - Zn
 - Fe
 - Cu

Cluster Growth vs. Time



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