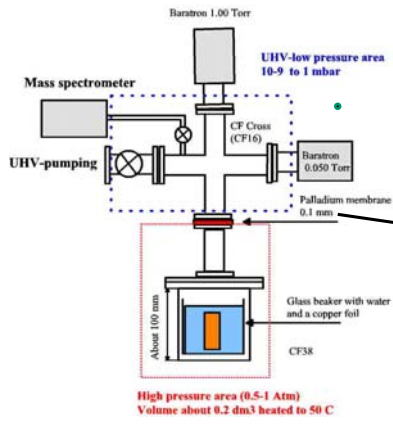



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Corrosion of Copper in oxygen free water Experimental set-up

Vacuum system for measurements of hydrogen production during copper corrosion.

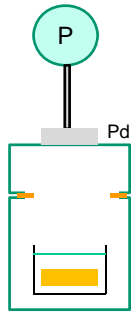
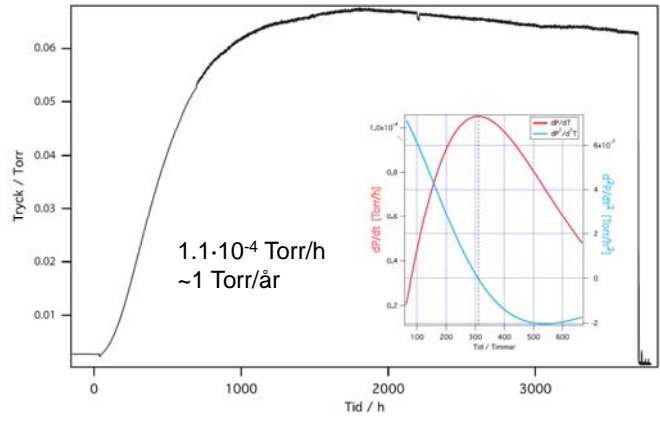
**High pressure area (0.5-1 Atm)
Volume about 0.2 dm³ heated to 50 C**



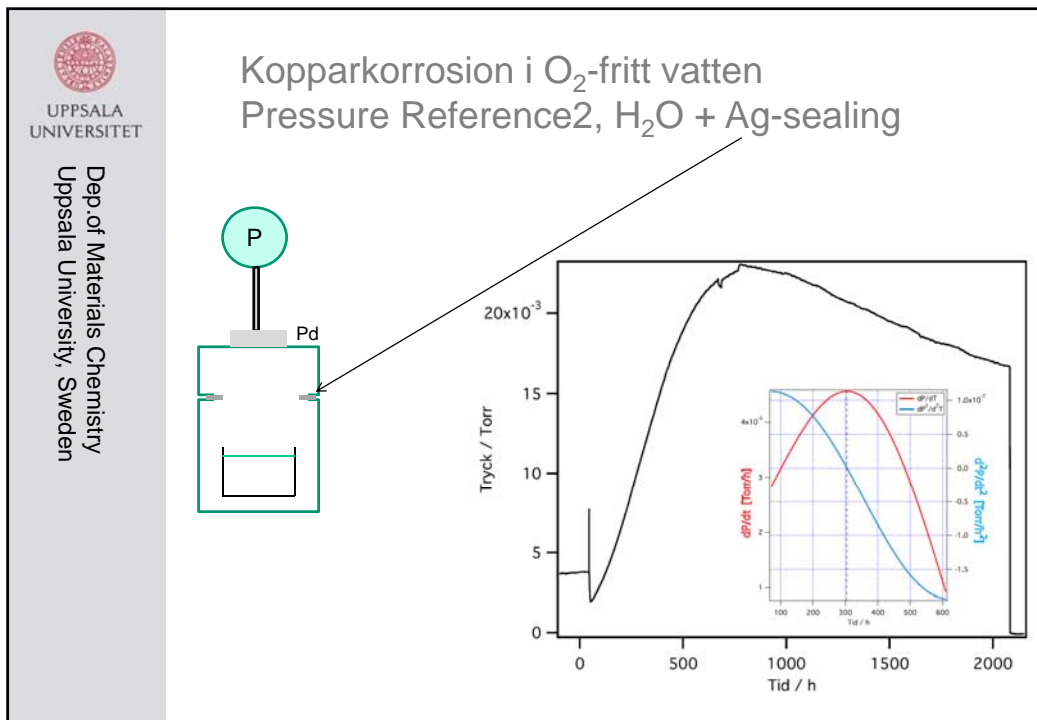
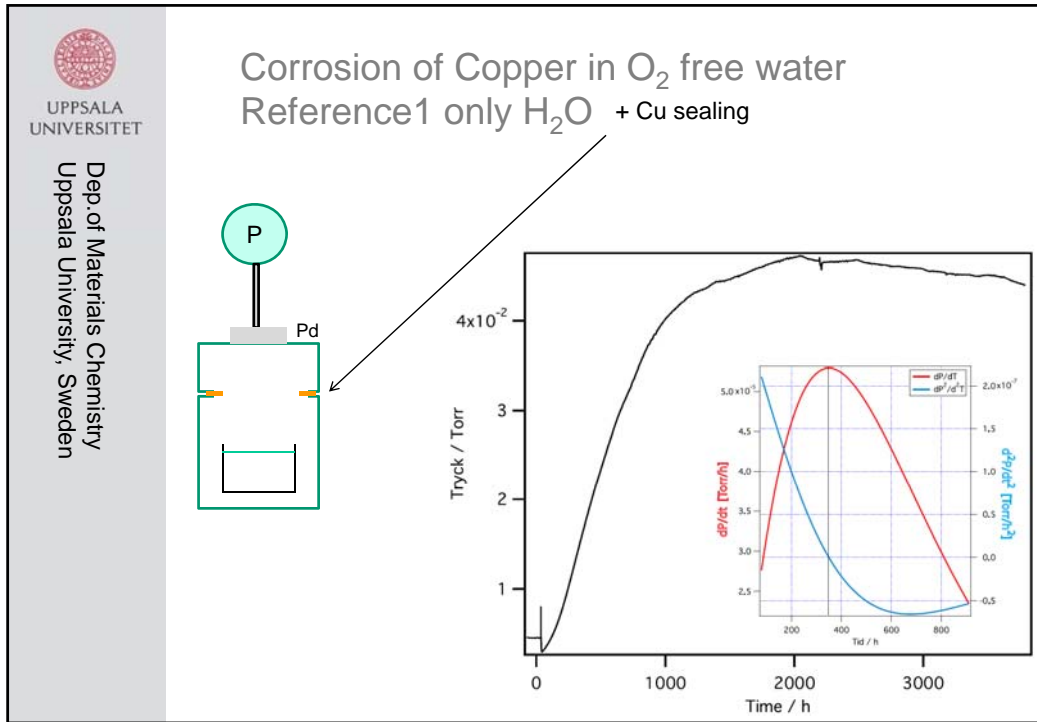
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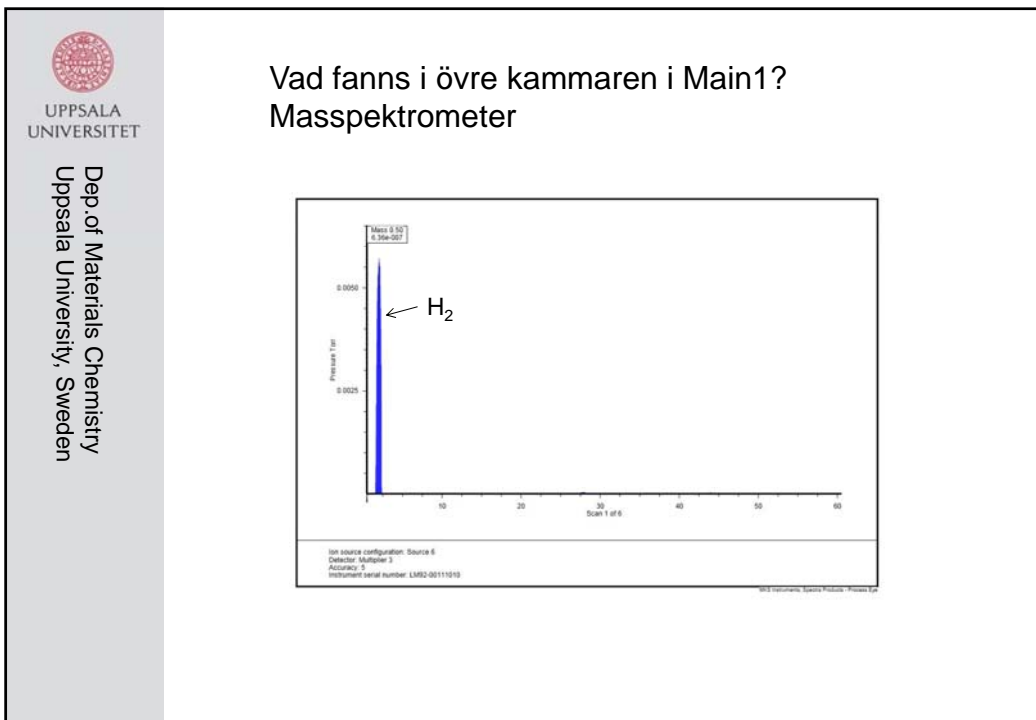
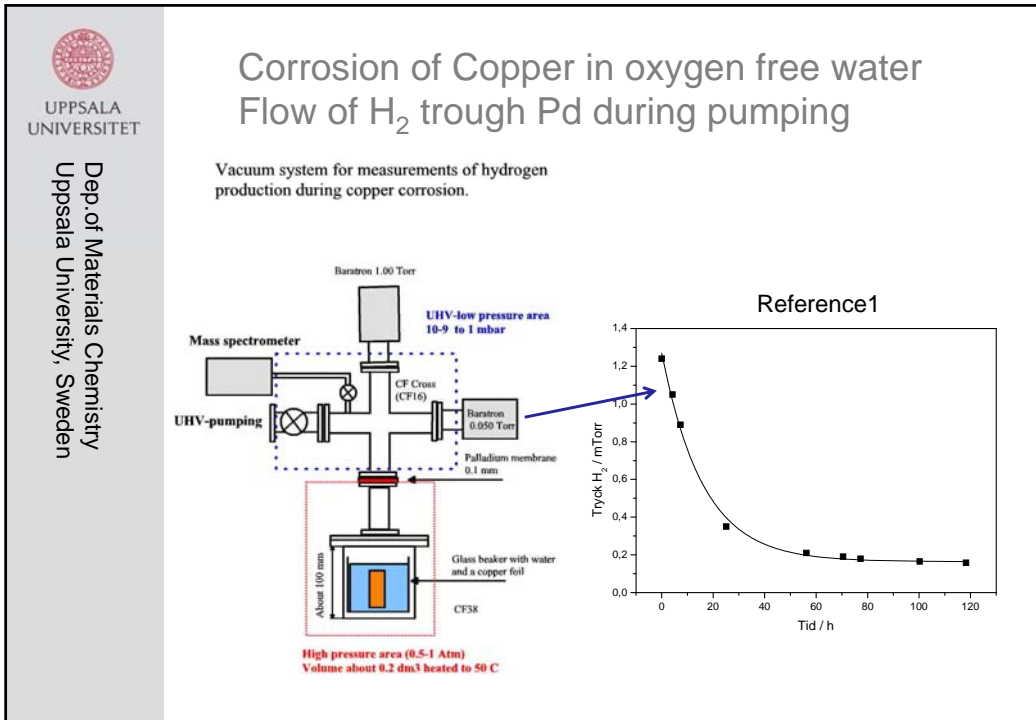
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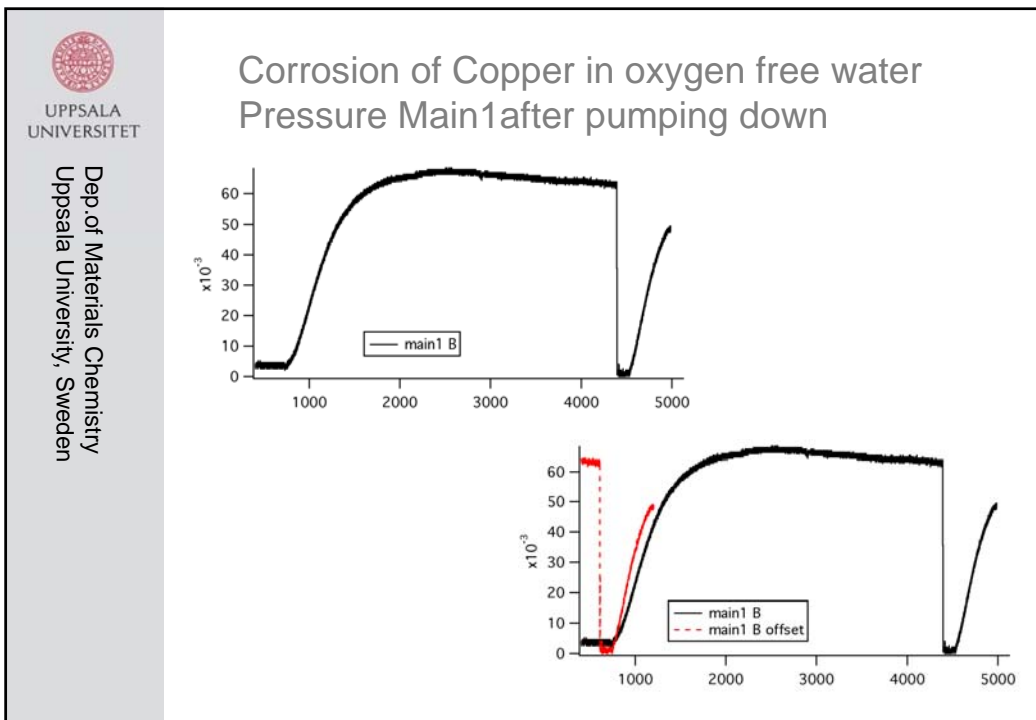
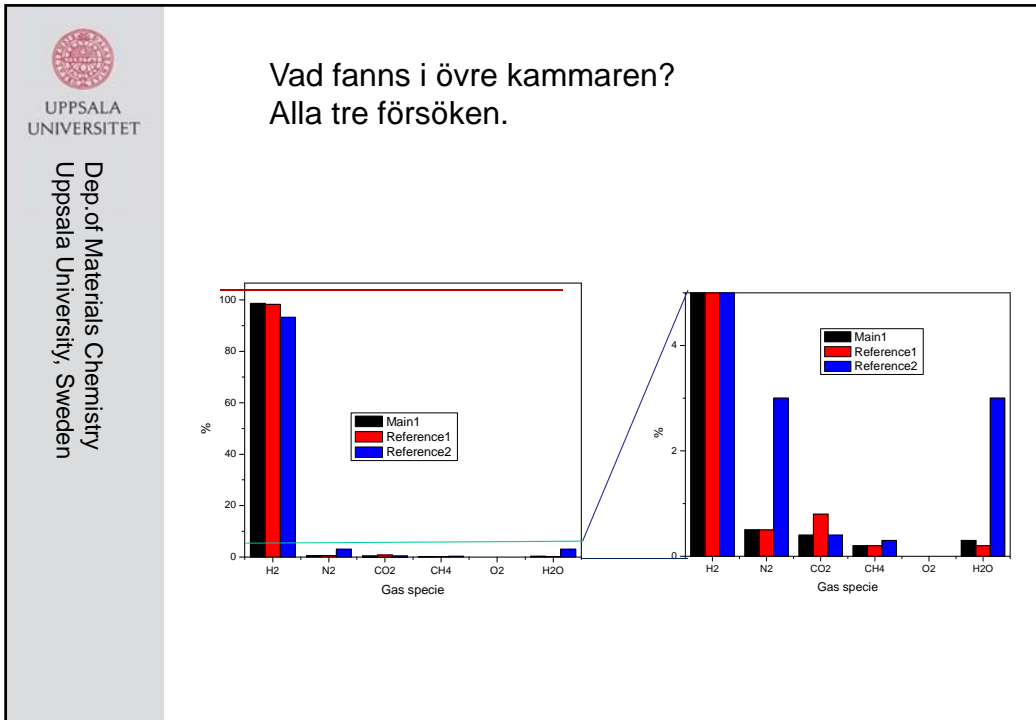
Corrosion of Copper in oxygen free water Result Cu + H₂O

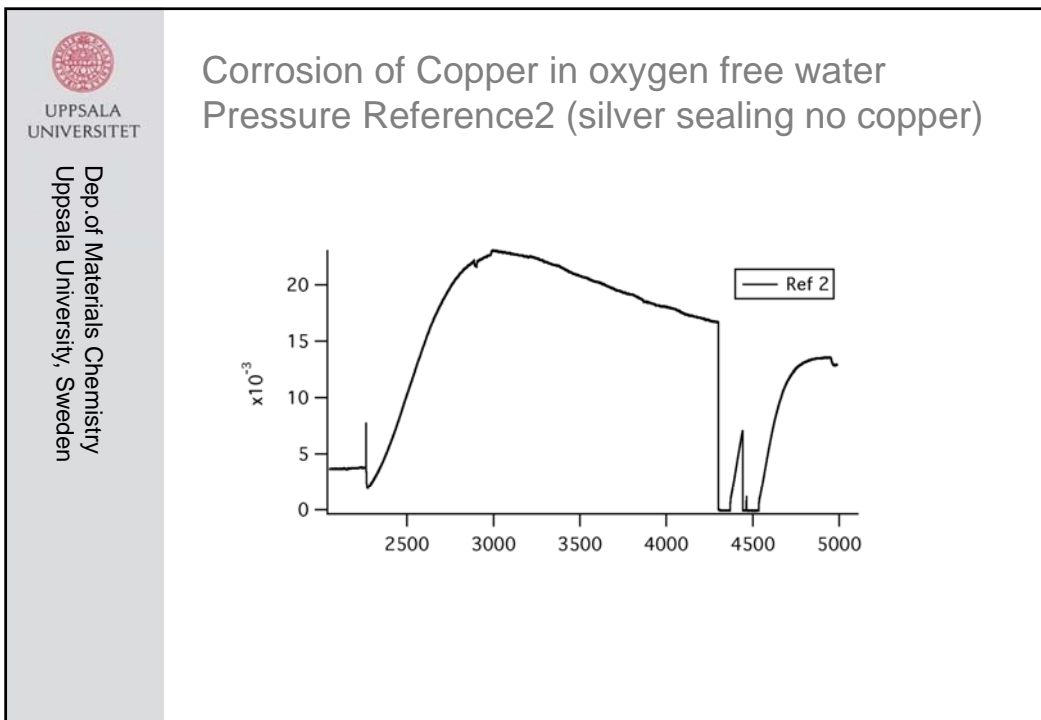
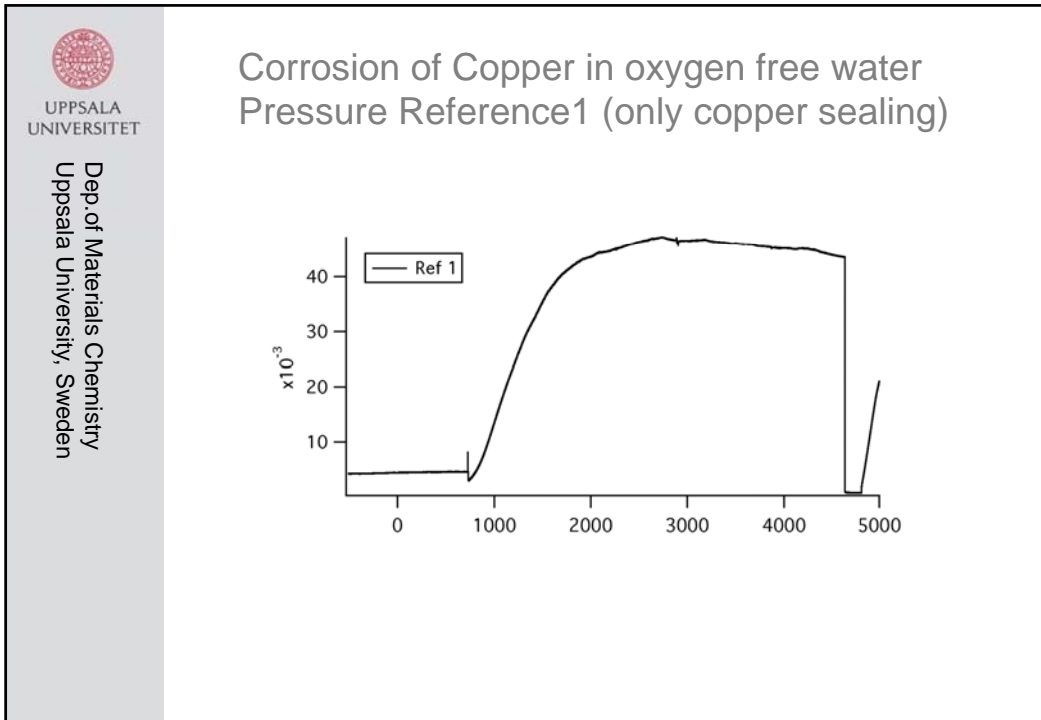



1.1 · 10⁻⁴ Torr/h
~1 Torr/år











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Sammanfattning - tryckexperimenten

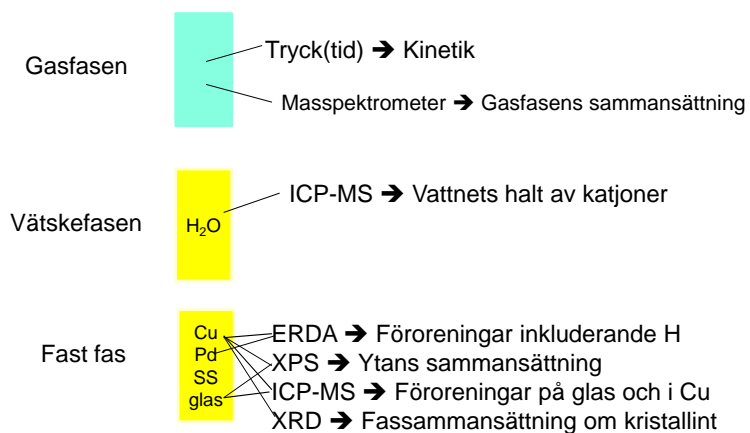
- Trycket ökar i övre kammaren vilket beror på att H_2 diffunderar in.
- Trycket sjönk under de första timmarna för att sedan öka exponentiellt. Efter ca 350 h avtog ökningstakten och efter ca 2200 timmar så erhöles ett maximalt tryck på 0.067 Torr.
- Trycket ökade även i den övre kammaren när enbart vatten fanns i den undre kammaren. Ökningstakten var lägre och ett maximalt tryck på 0.047 Torr erhöles efter ca 2200 timmar.
- När kopparpackningen i vacuumförseglingen byttes ut mot en silverpläterad packning erhöles ett maximalt tryck på 0.023 Torr efter ca 800 timmar.
- Enbart O_2 -fritt (<1 ppb) H_2O fanns i nedre kammaren efter kontrollmätning.
- Efter urpumpning av övre kammaren i 5-6 dagar så ökade trycket igen, dvs vätgas har strömmat in via/från palladiummembranet. Försök pågår.




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Koppars korrosion i molekylärt syrefritt vatten Varifrån kommer vätgas och korrosionsprodukter?



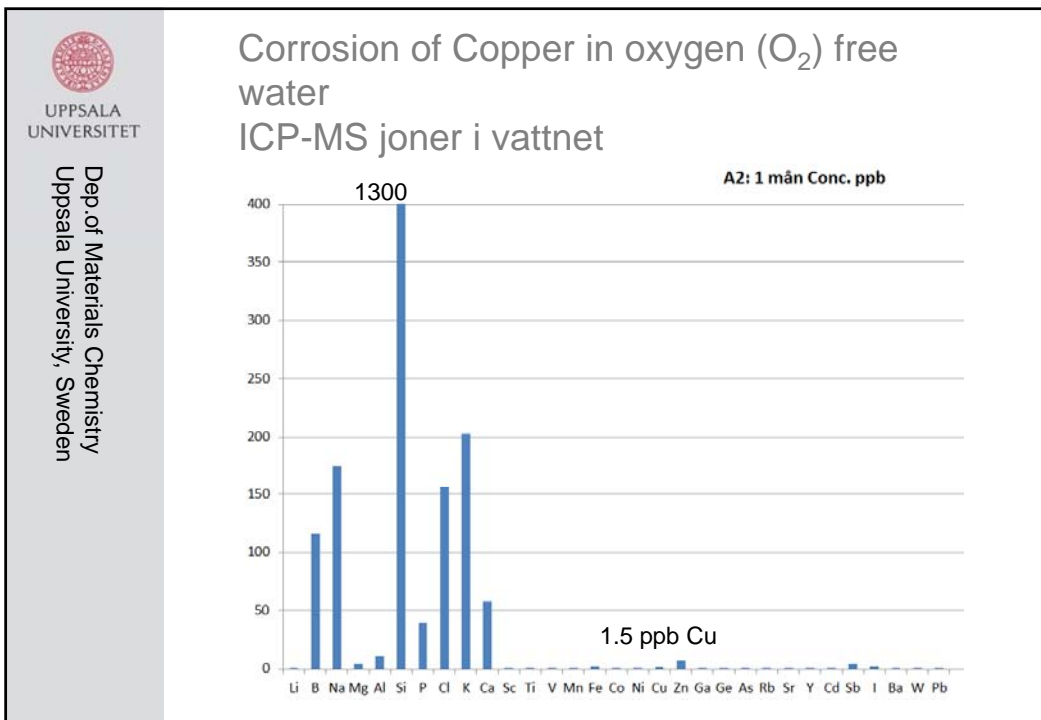

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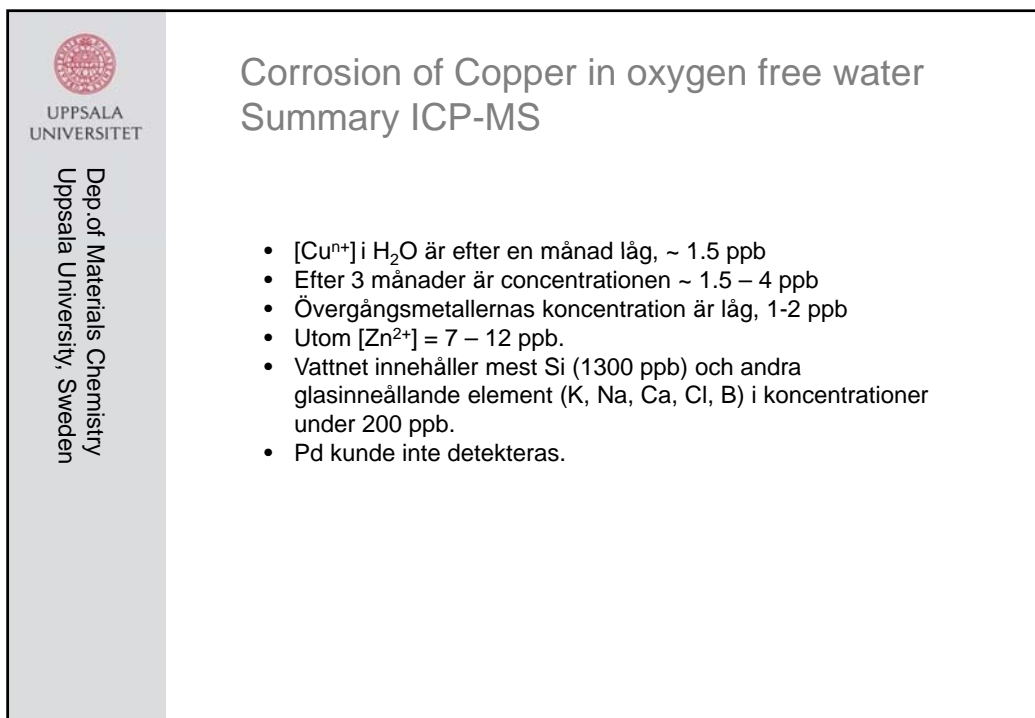
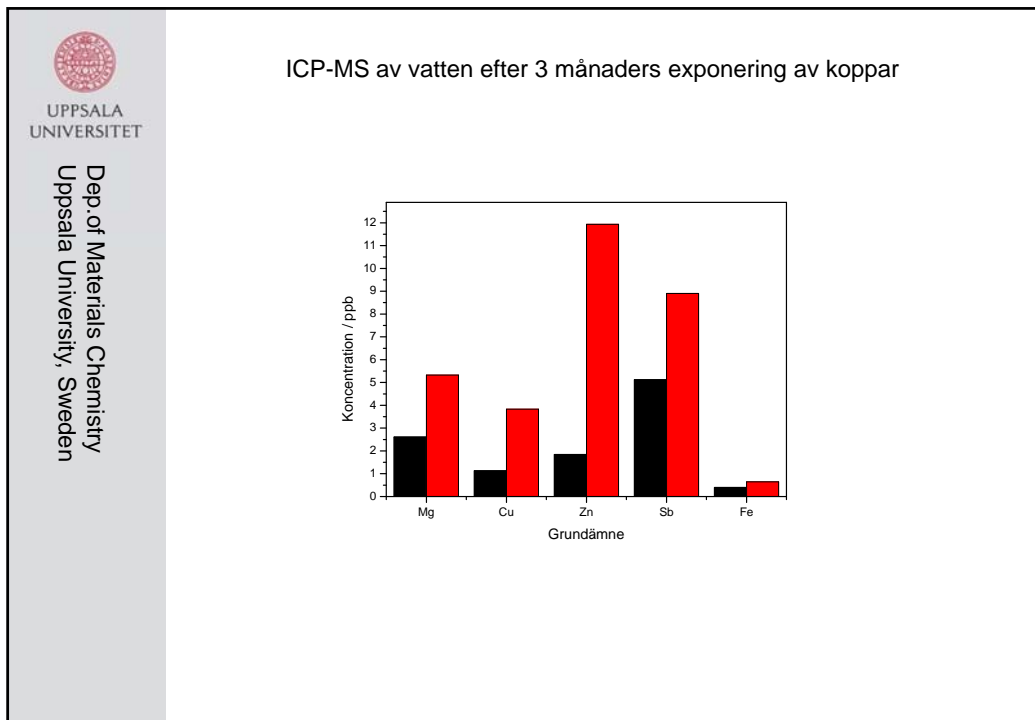
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Corrosion of Copper in oxygen free water ICP-MS

Marcus Korvela

Bioanalytical Chemistry
Biomedical center
Uppsala University

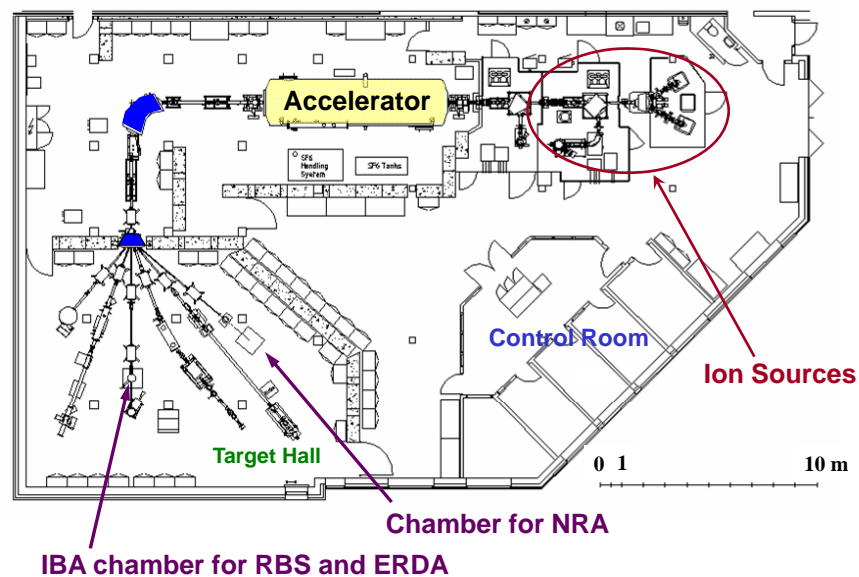




Ion Beam Materials Analysis

- Analysis of impurities in Cu-Foils (SKB)
- Presentation of applied methods
 - Summary of obtained results
- Tandemlaboratoriet – Uppsala Universitet
 - Göran Possnert & Daniel Primetzhofer

Tandem Laboratory, Uppsala University



Ion Beam Analytical techniques

RBS
Rutherford backscattering spectrometry

ERDA
Elastic Recoil Detection Analysis

NRA
Nuclear reaction analysis

PIXE
Particle induced x-ray emission

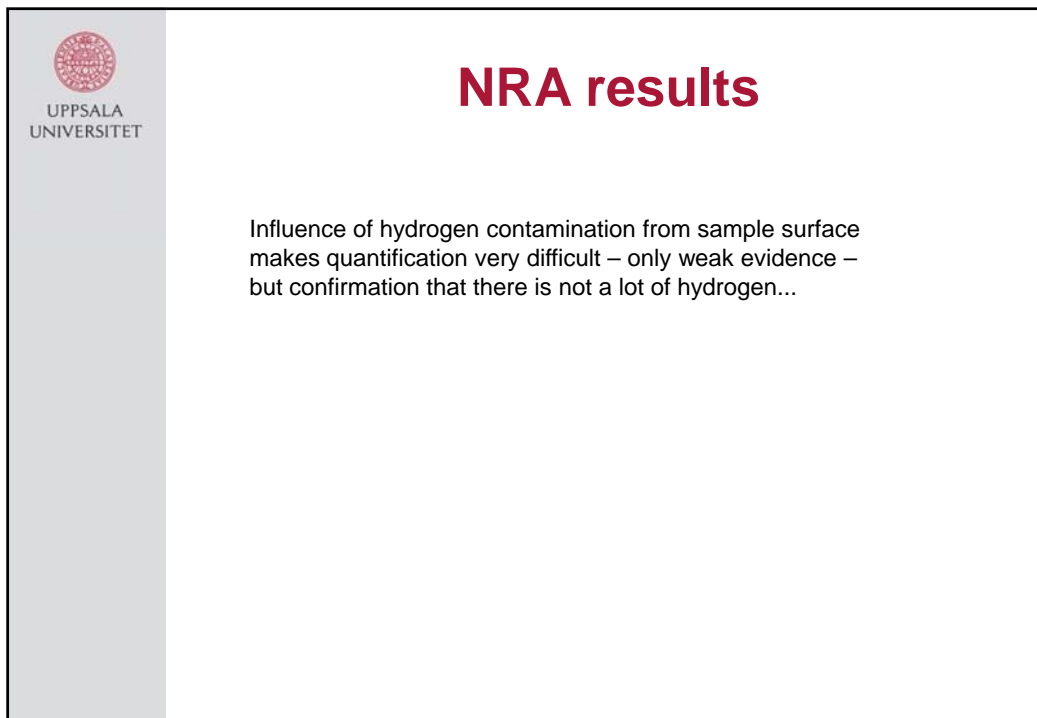
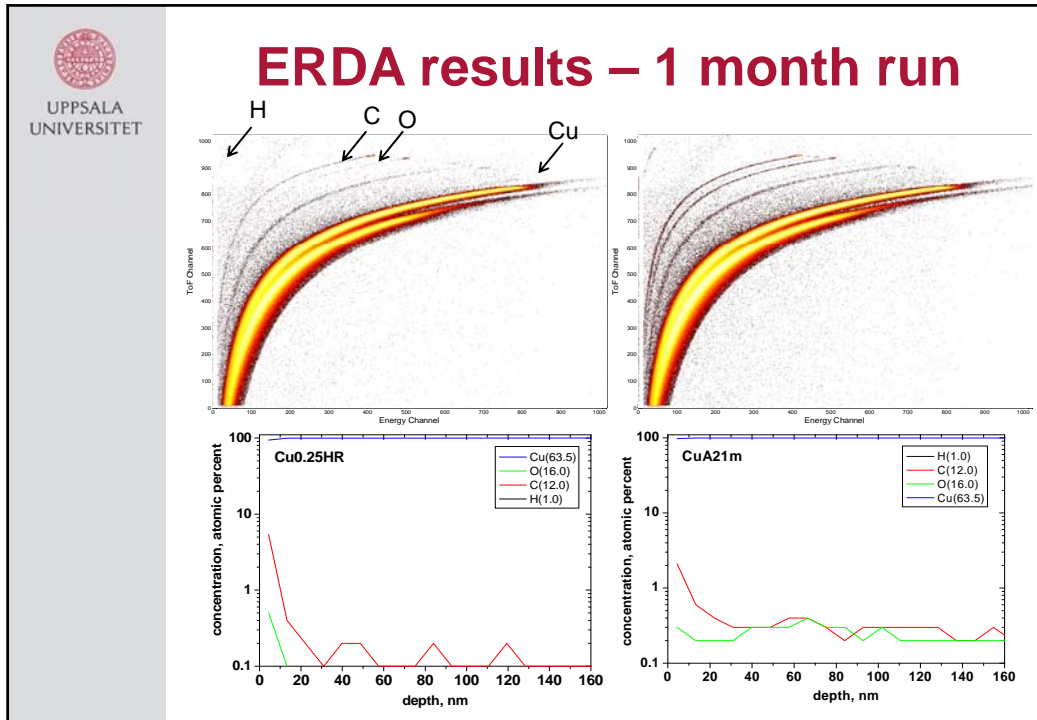
ERDA results


Cu-Electropolished

Cu-Hydrogen reduced

Pd

Lower levels of H,C and O in Hydrogen reduced sample





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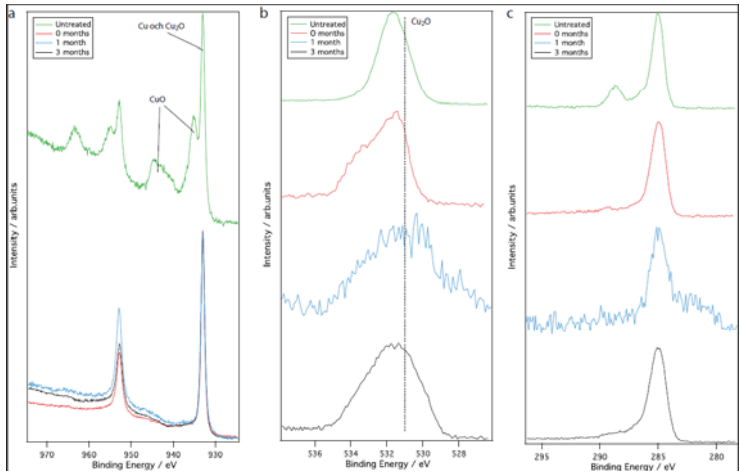
Corrosion of Copper in oxygen free water Sammanfattning ERDA NRA

- Ytkoncentrationen av H i Cu blir lägre efter vätgasreduktion och värmebehandling under UHV.
- Ytkoncentrationen av H i Cu ökar efter en eller tre månader i rent O₂-fritt vatten.


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Corrosion of Copper in oxygen free water XPS resultat



The figure displays three XPS spectra (a, b, and c) showing intensity versus binding energy (eV) for copper samples under different conditions. Each plot compares untreated, 0 months, 1 month, and 3 months in oxygen-free water. Plot (a) shows Cu 2p peaks for Cu and Cu₂O. Plot (b) shows Cu 2s peaks for Cu and Cu₂O. Plot (c) shows Cu 1s peaks for Cu and Cu₂O.

