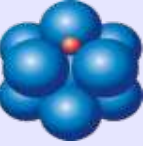


Katalytische Eigenschaften von Gold Clustern

Photoelektronenspektroskopie an Metallclustern

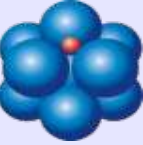
Moritz Bubek

Diplomandenseminar, 08.02.2006



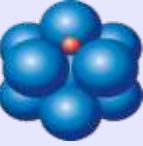
Übersicht

- Motivation
- Was sind Cluster?
- Grundlagen der Katalyse
- Experimenteller Aufbau
- Ergebniss(e)



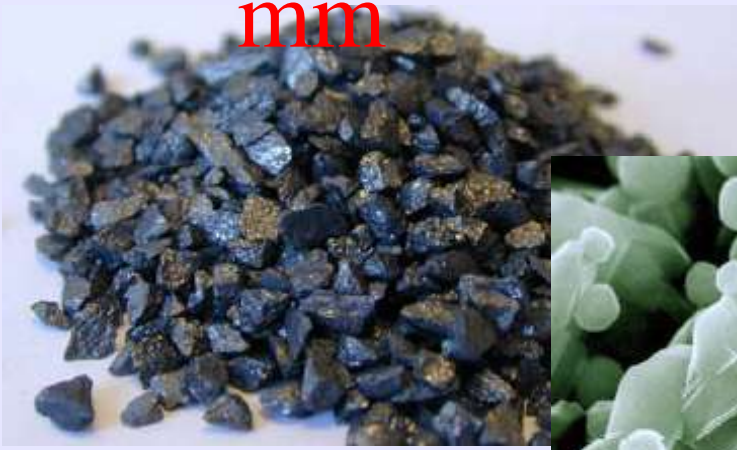
Warum ist Katalyse interessant?

- Katalyse seit 4000 Jahren benutzt
- seit 150 Jahren bewusst
- 80% aller chemischen Verfahren (z.B. Ammoniak) Quelle: wikipedia
- Mechanismen sind aber immer noch nicht vollständig verstanden



Zoom in

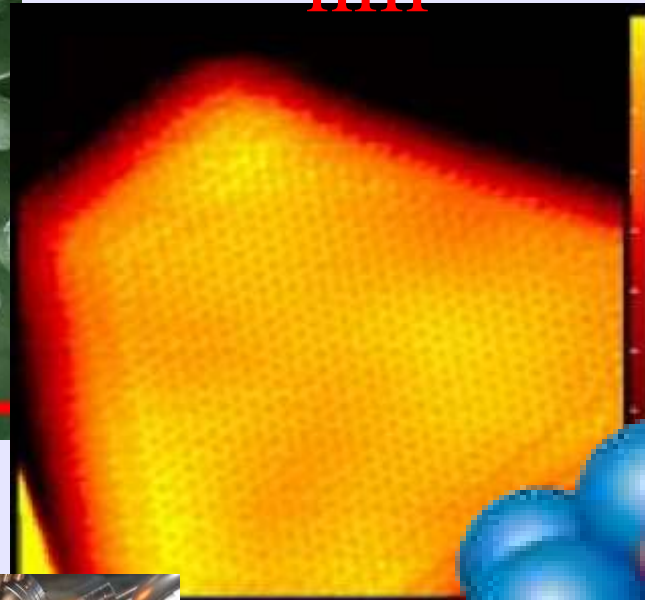
mm



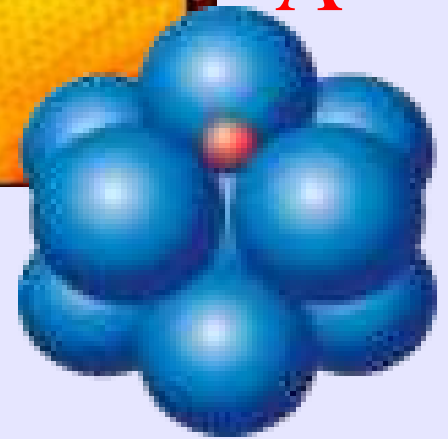
μm



nm



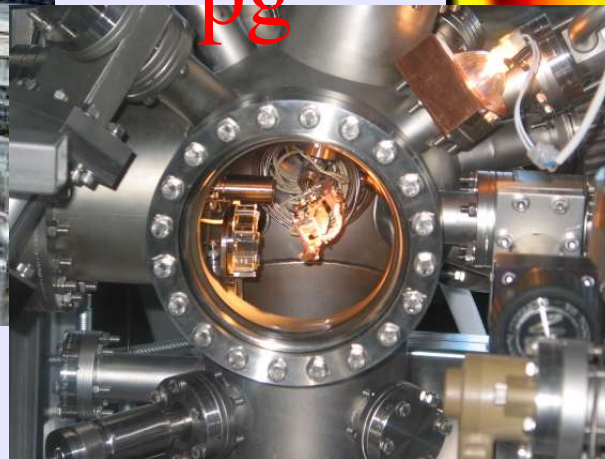
A



kt



pg

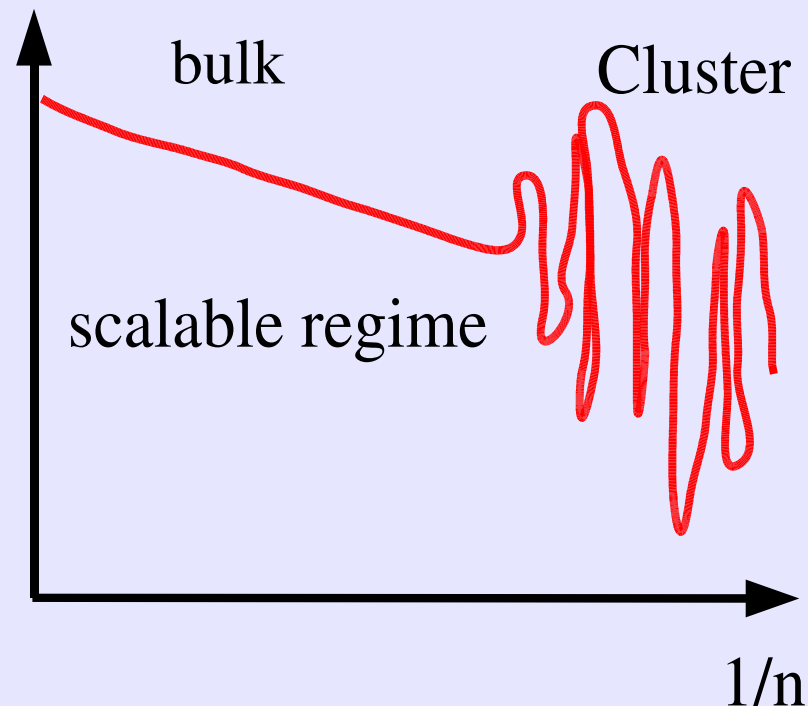


Quelle: <http://dcwww.camp.dtu.dk/~bligaard/>

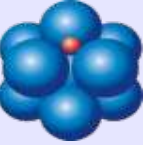


Was ist ein Cluster?

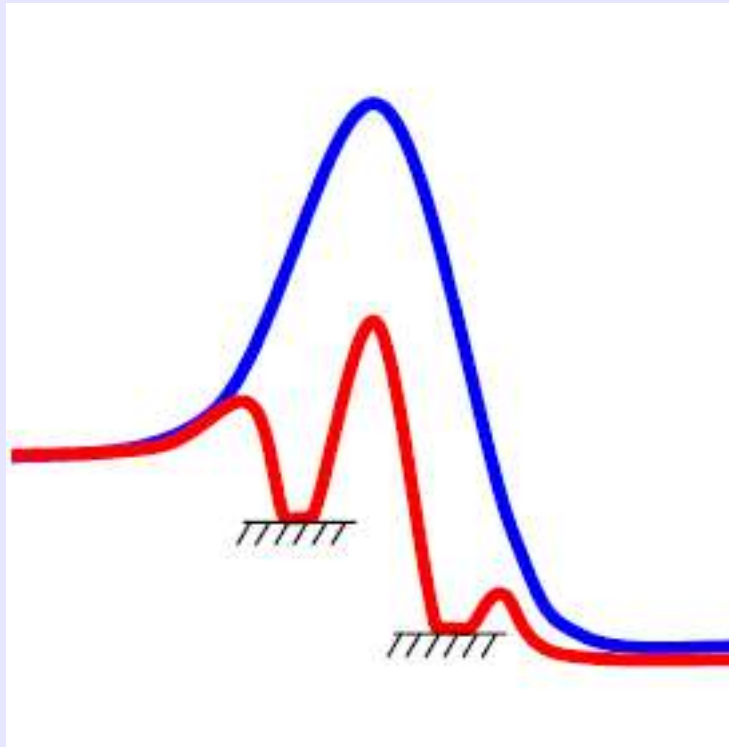
- $n = 2-10000$ Atome
- wegen geringer Größe abweichende Eigenschaften zum Festkörper
- Übergang zwischen Atom und Festkörper



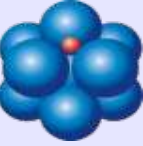
every atom counts



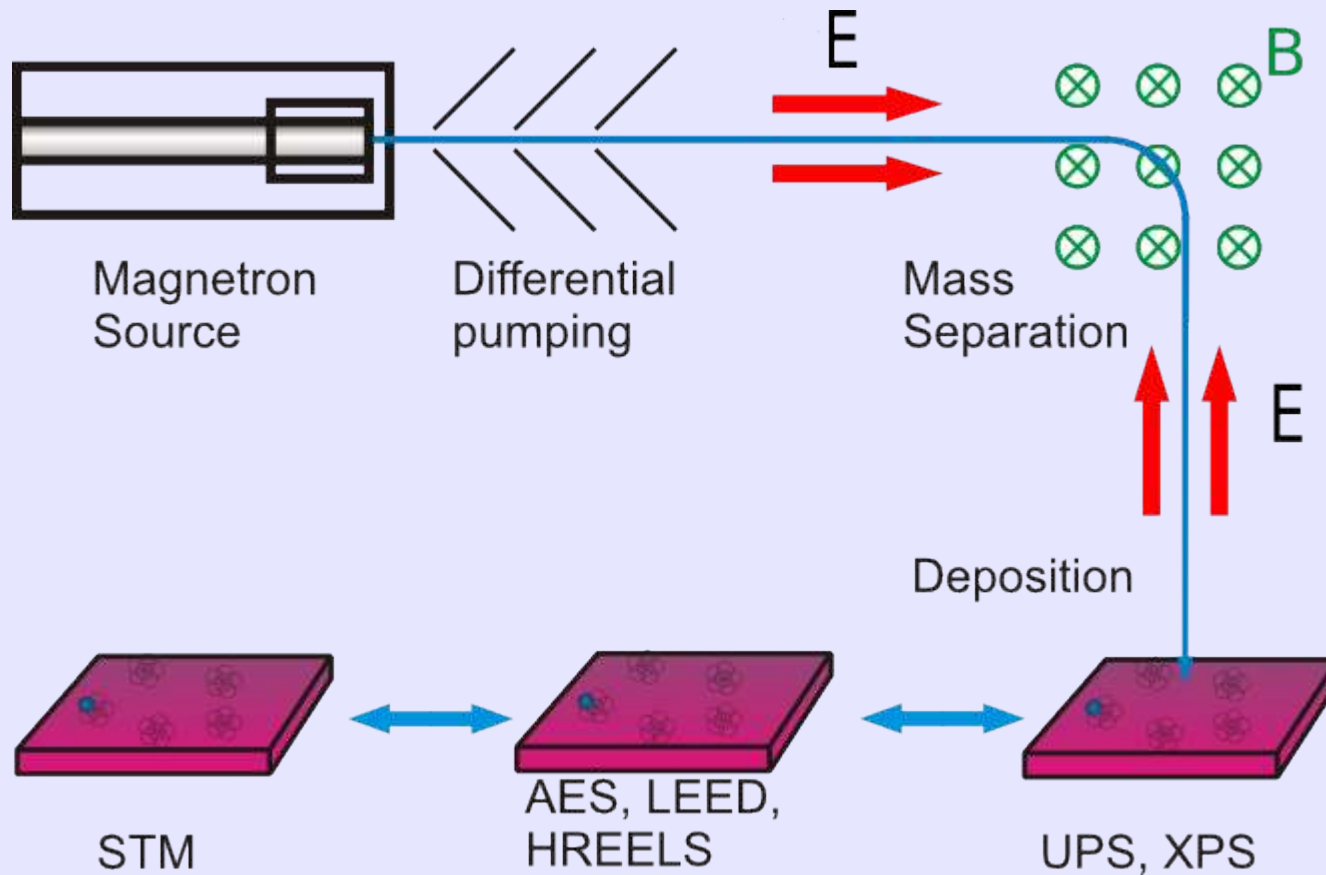
Grundlagen zur Katalyse

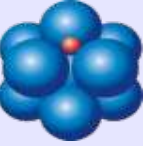


- auch exotherme Reaktion benötigt Aktivierungsenergie
- durch Zwischenprodukte/stadien wird verringert
- Katalysator nimmt an Reaktion teil

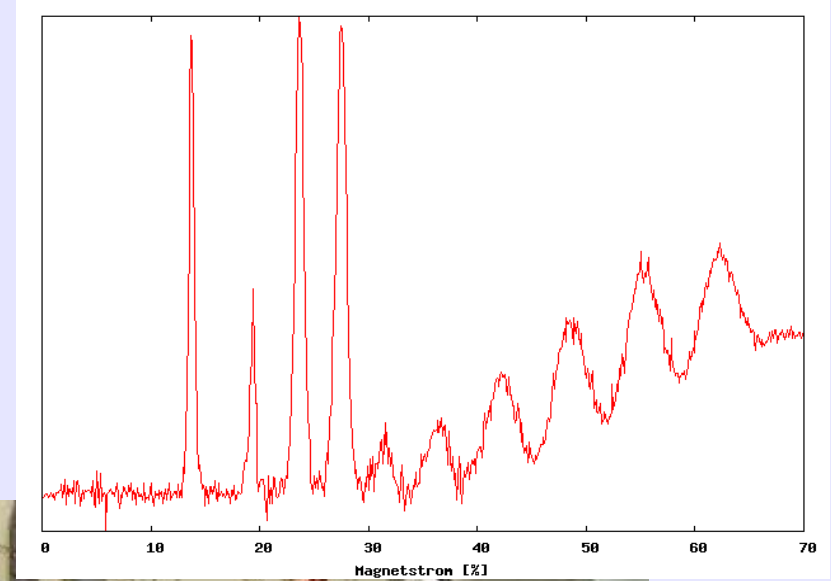
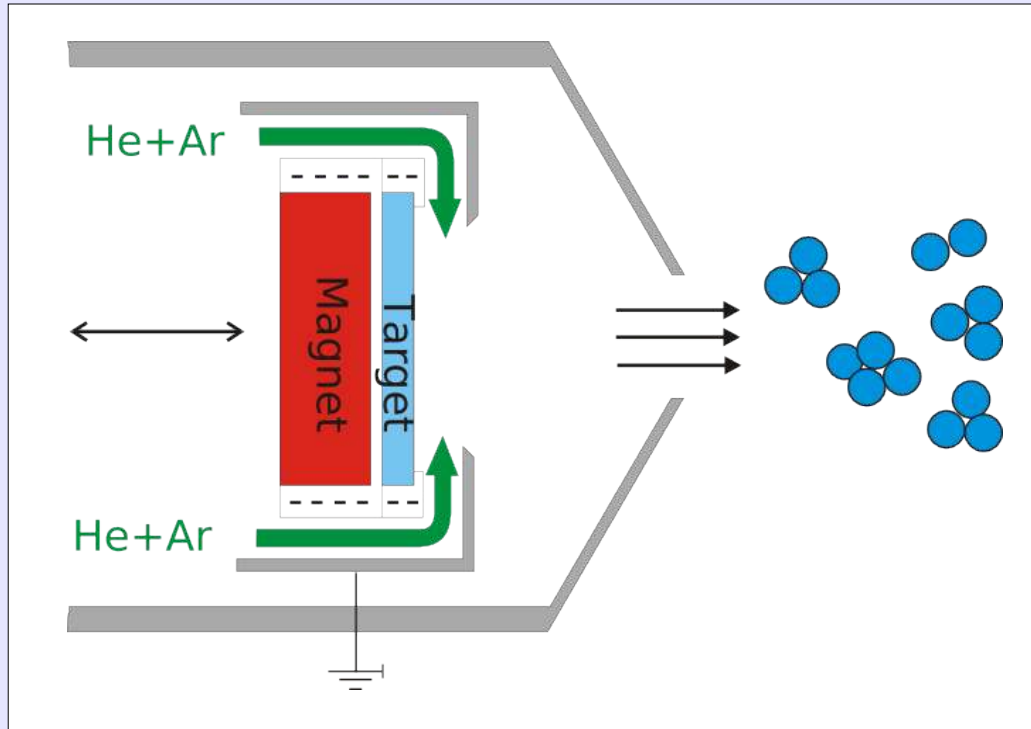


Experimenteller Aufbau Cluster Deposition

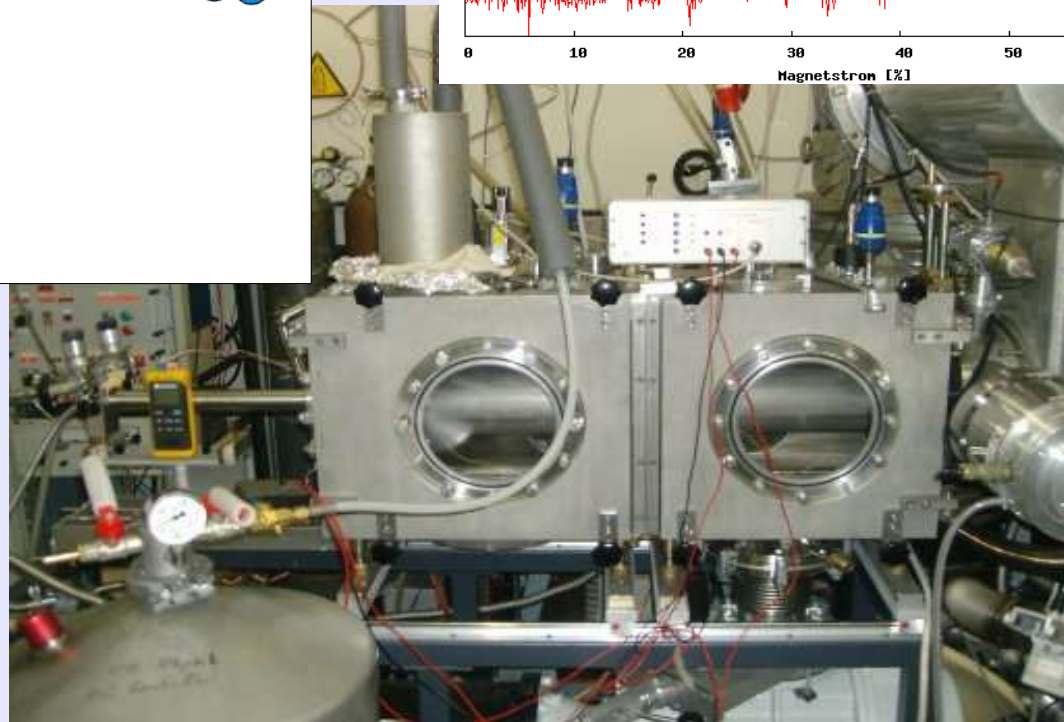




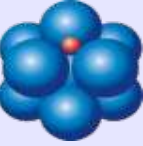
Magnetron Sputter Quelle

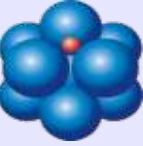


- hoher Strom
- konstant, nicht gepulst



Katalytische Eigenschaften von Gold Clustern

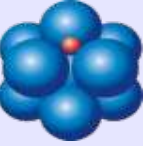




X-ray Photoelectron Spectroscopy

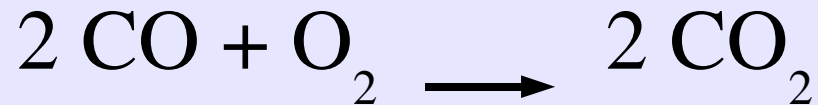
Einstein, 1905 $E_k = h\nu - E_B - WF$

- Innerschalenelektronen werden rausgeschlagen
- Elementspezifisch
- sensitiv auf chemische Umgebung, d.h. auf Bindungstyp, bzw Bindungspartner
- “chemical shift” durch Elektronendichte der anderen Atome am Kernort

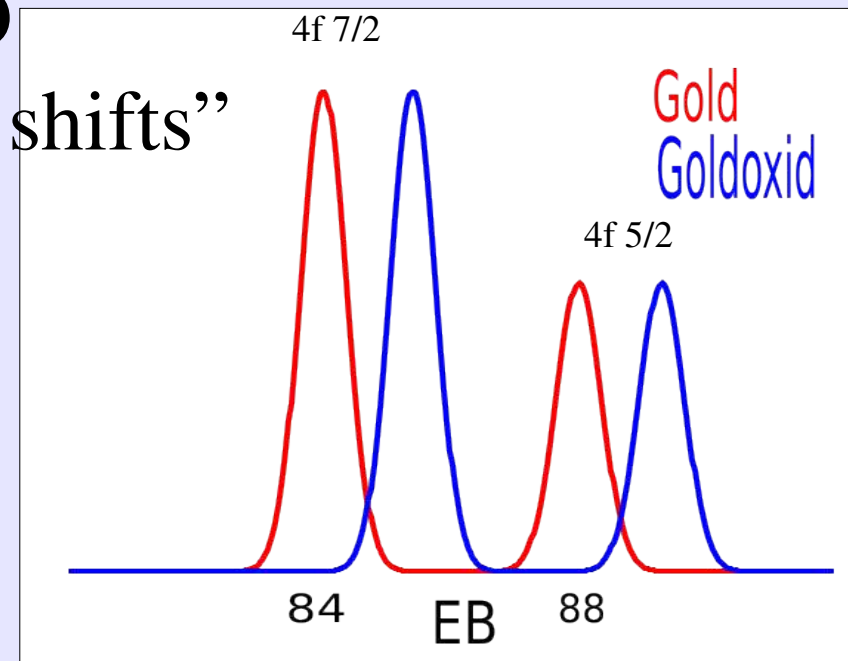


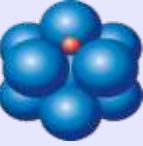
Kohlenmonoxidoxidation

- einfache Modellreaktion für Katalyse

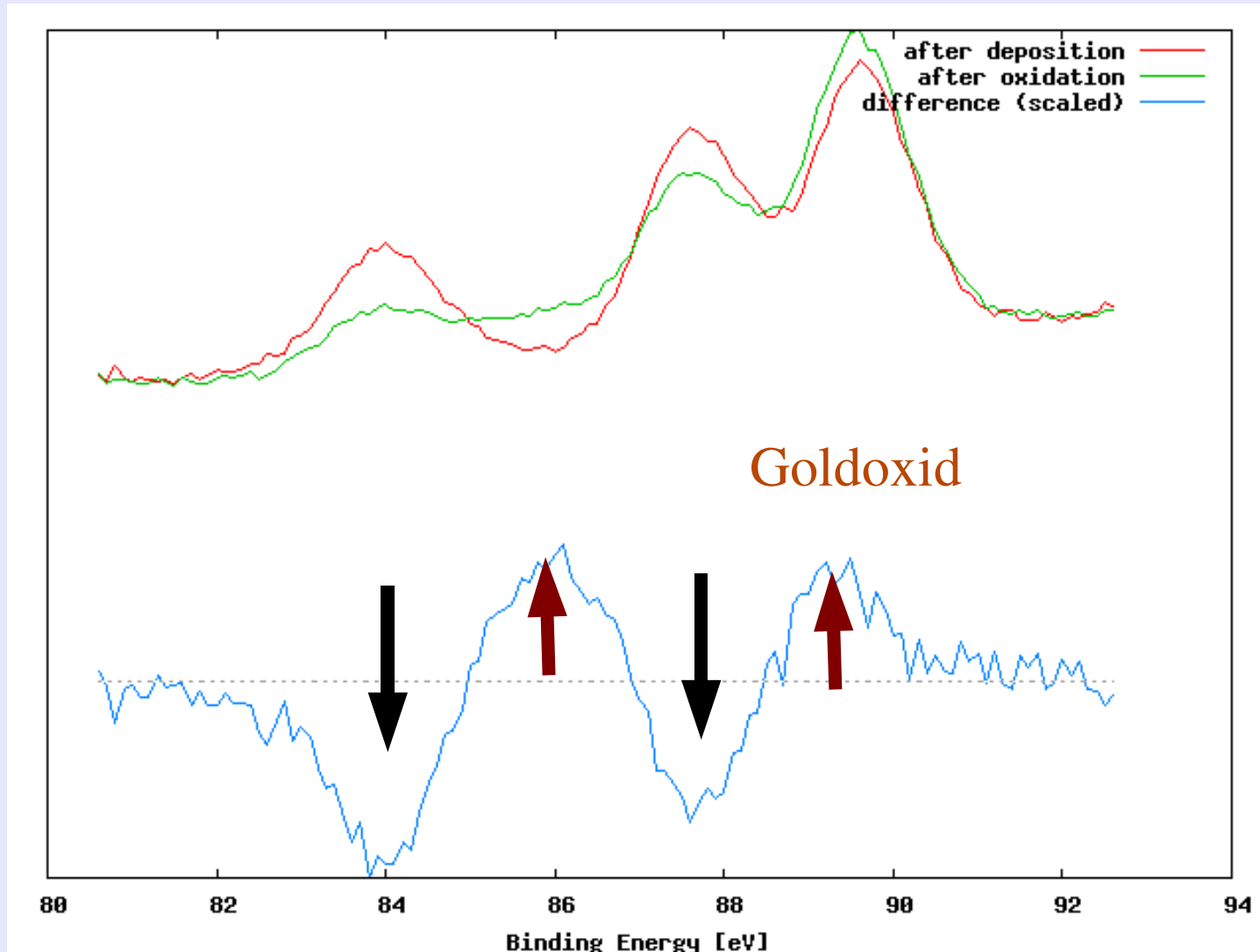


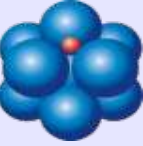
- Zugabe von 8.0×10^{-5} mbar Sauerstoff
- Zugabe von 3.0×10^{-5} mbar CO
- Beobachtung des “chemical shifts”



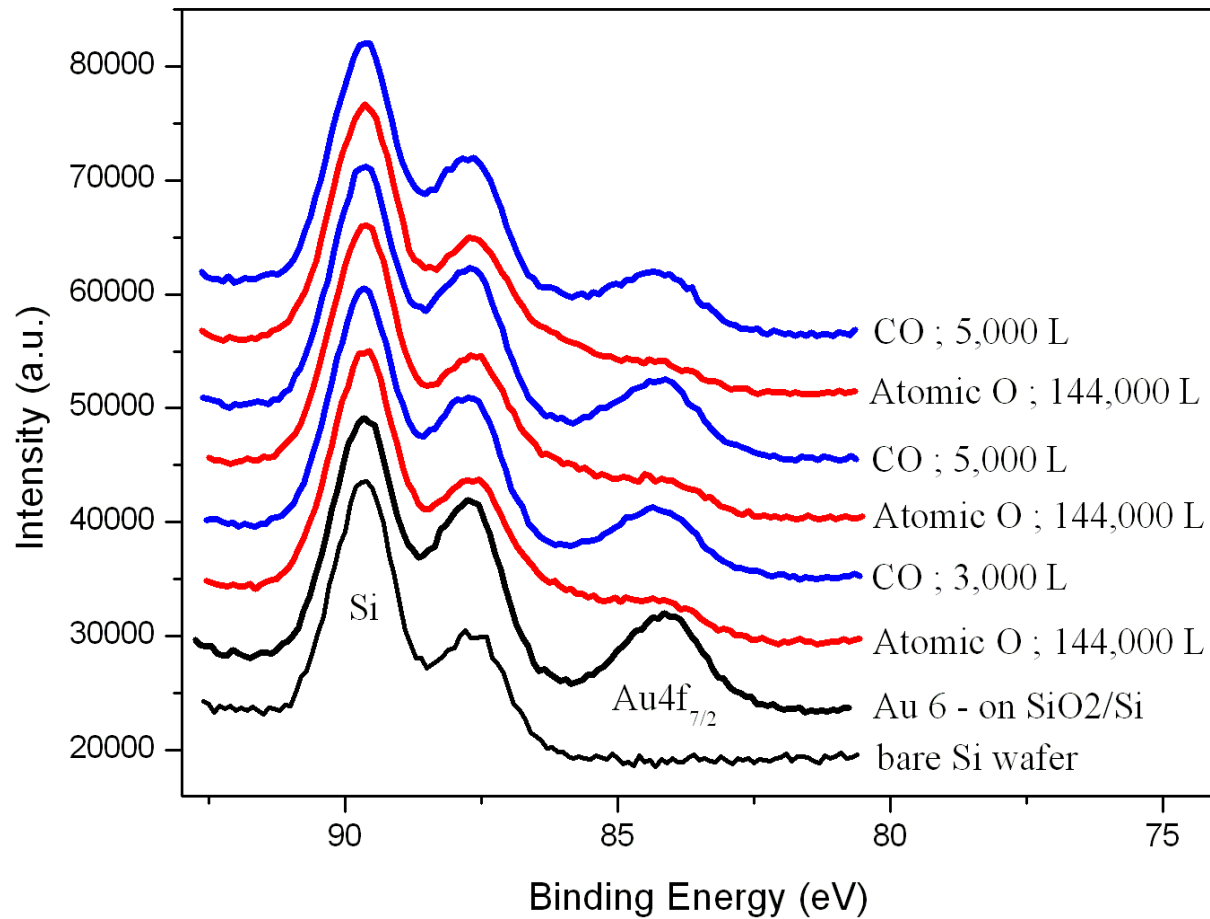


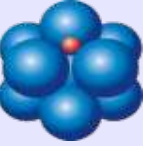
Au 10





Au6 katalytisch aktiv?





gerade ungerade Alternierung?

