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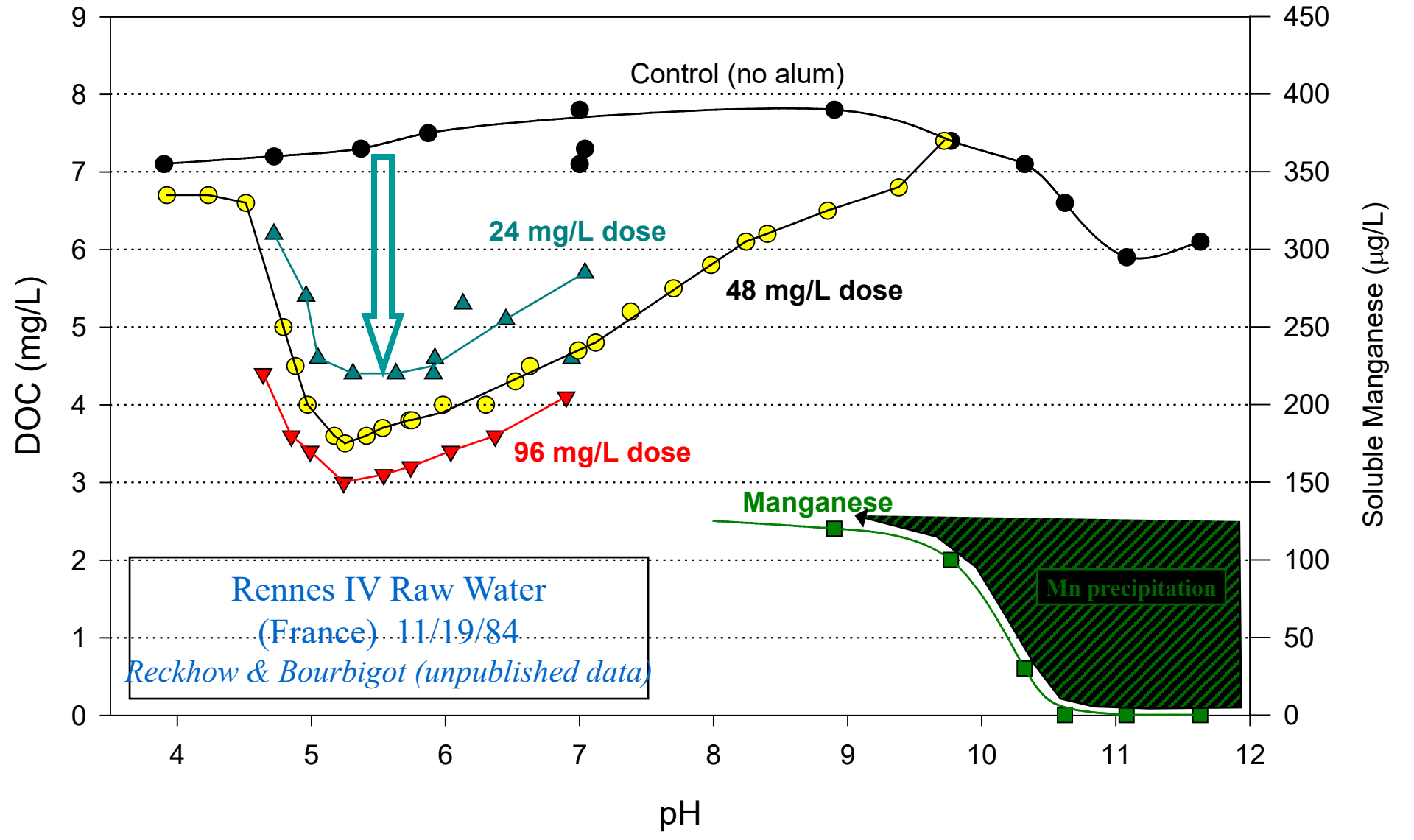
CEE 680: Water Chemistry

Lecture #36

Precipitation and Dissolution: Other Metal Hydroxides

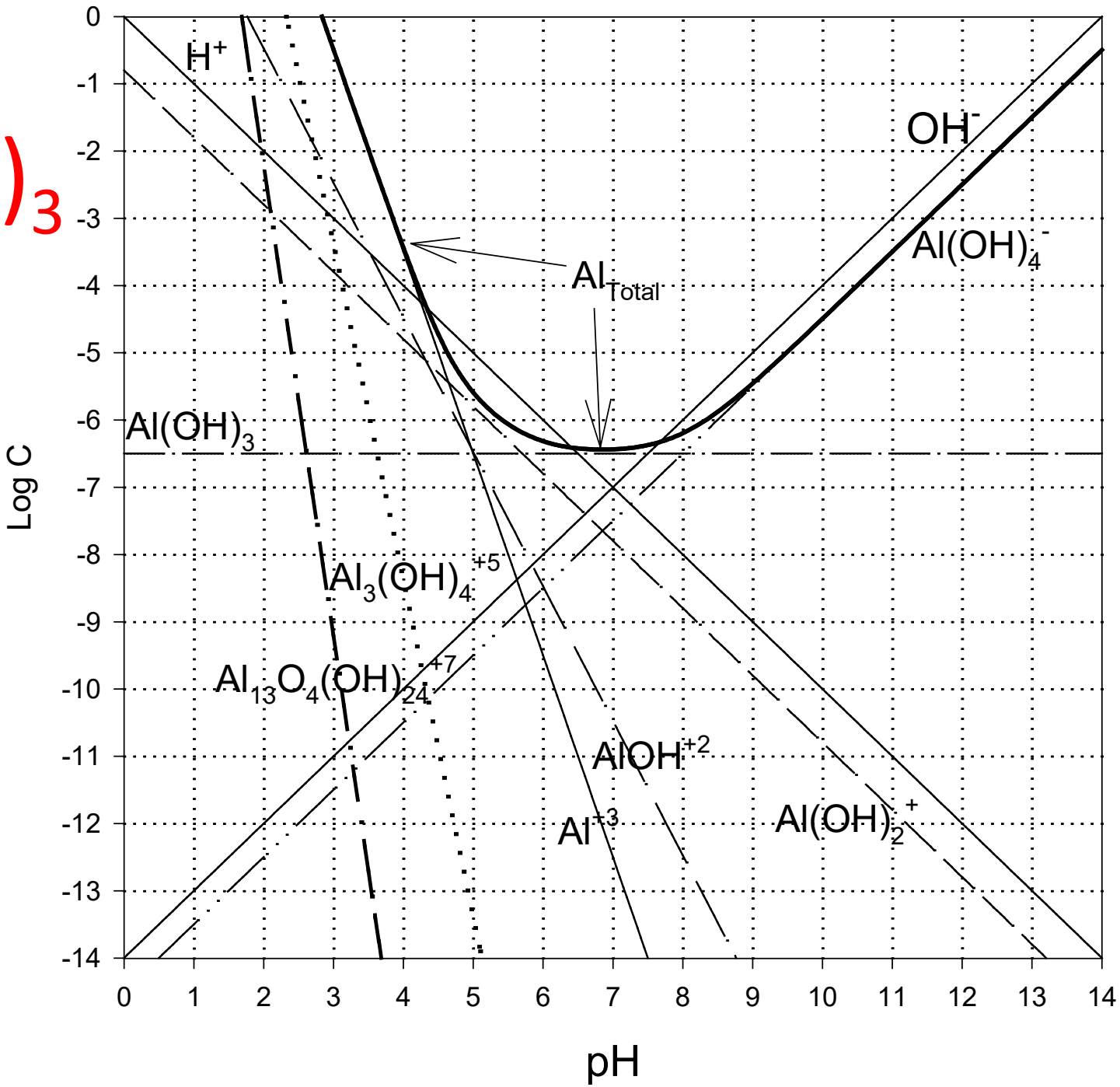
(Stumm & Morgan, Chapt.7)

Benjamin; Chapter 8.7-8.15


Control (no alum)
24 mg/L dose
48 mg/L dose
96 mg/L dose
Manganese
Mn precipitation
Rennes IV Raw Water
(France) 11/19/84
Reckhow & Bourbigot (unpublished data)
DOC (mg/L)
Soluble Manganese (µg/L)
pH
0
1
2
3
4
5
6
7
8
9
0
50
100
150
200
250
300
350
400
450
4
5
6
7
8
9
10
11
12

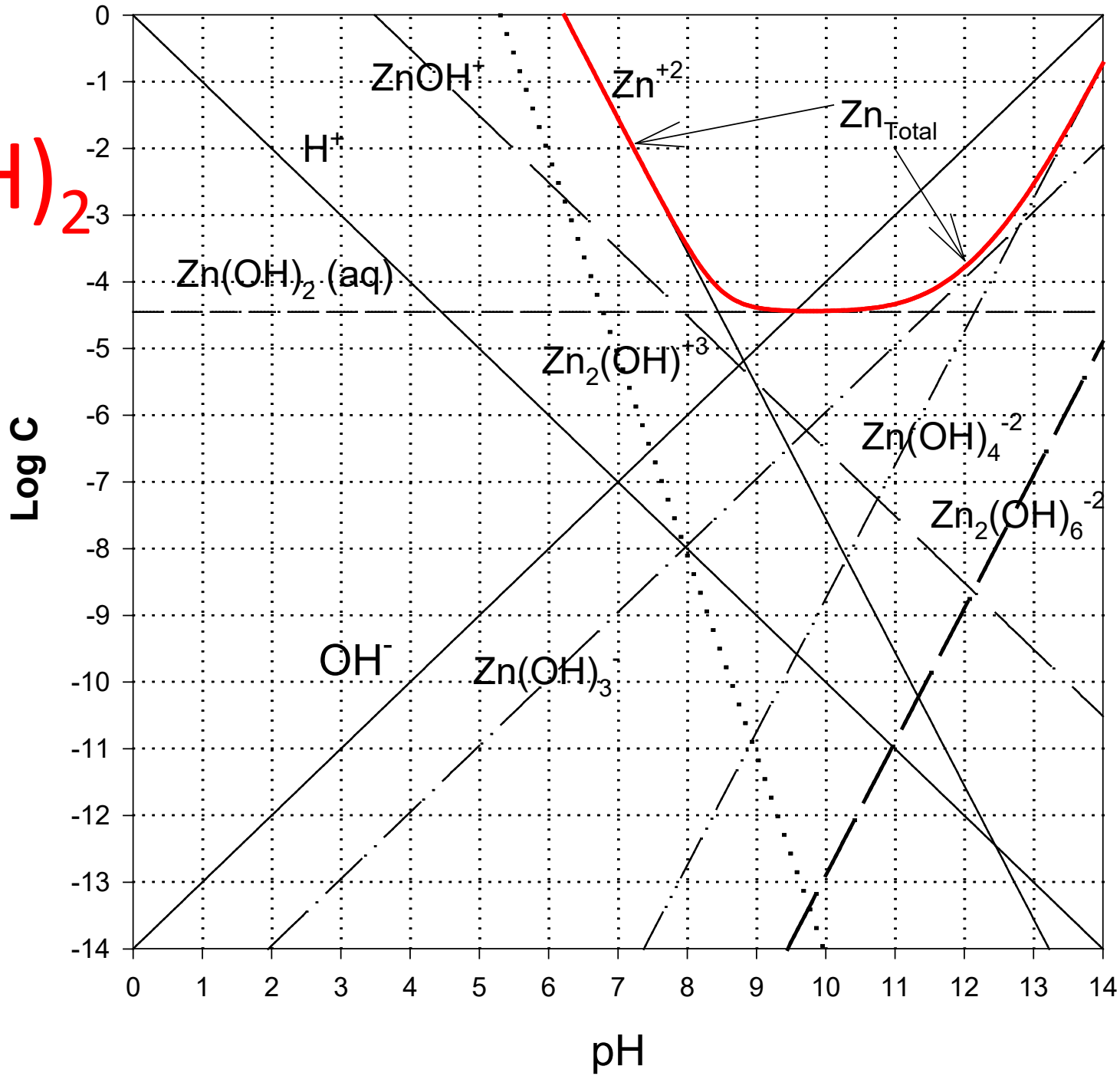
$Al(OH)_3$

- Al solubility
- Compare to Stumm & Morgan's fig. 6.8a, pg.273



$Zn(OH)_2$

- Zn solubility
- Compare to Stumm & Morgan's fig. 6.8c, pg.273



Chromium Hydroxide I

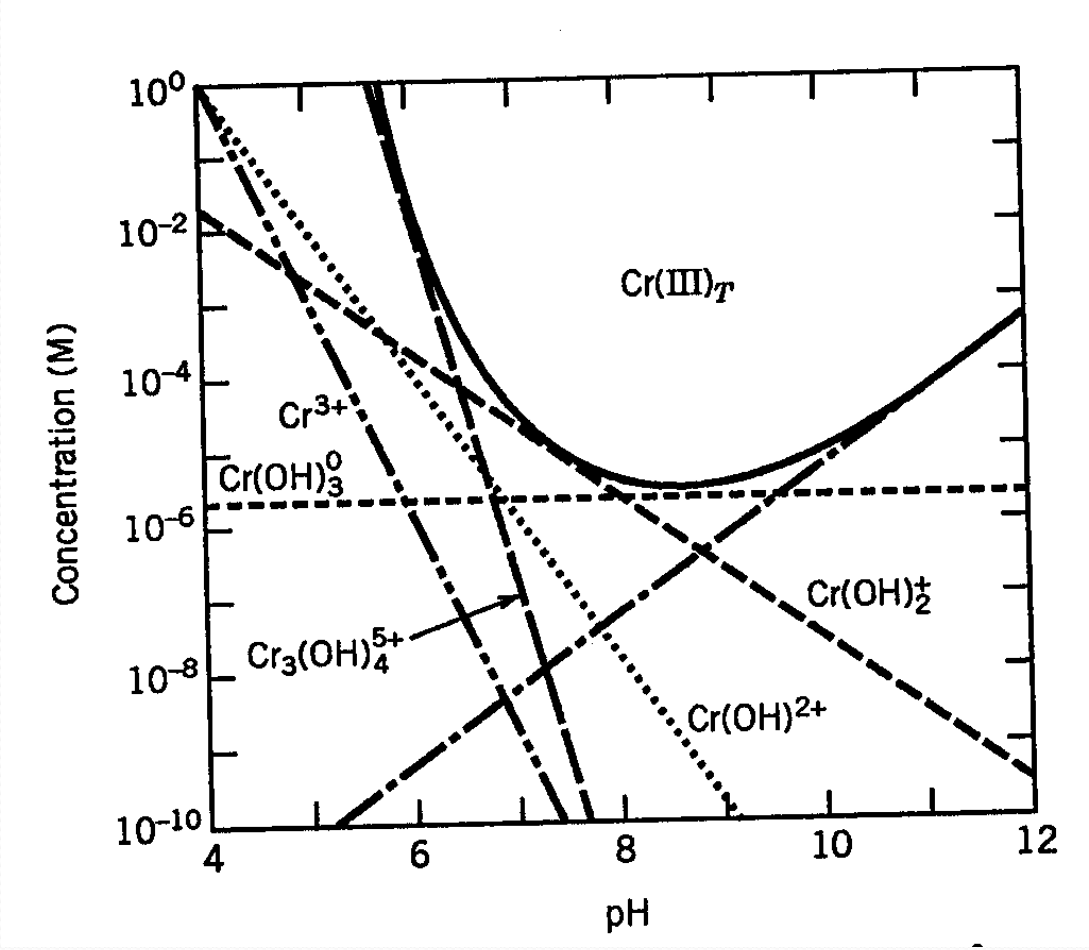
- Thermodynamic Data

Reaction	log K (I = 0)	log K (I = 0.01)
$Cr(OH)_3(s) = Cr^{3+} + 3\ OH^-$	−30.0	−29.4
$Cr^{3+} + OH^- = CrOH^{2+}$	10	9.8
$Cr^{3+} + 2\ OH^- = Cr(OH)_2^+$	18.3	17.9
$Cr^{3+} + 3\ OH^- = Cr(OH)_3(aq)$	24.0	23.7
$Cr^{3+} + 4\ OH^- = Cr(OH)_4^-$	28.6	28.1
$3\ Cr^{3+} + 4\ OH^- = Cr_3(OH)_4^{5+}$	47.8	47.5
$H^+ + OH^- = H_2O$	14.0	13.91

- Although "metastable", the $Cr(OH)_3$ (s) is thought to control solubility in wastewaters

Stumm & Morgan, 1996, pg. 365

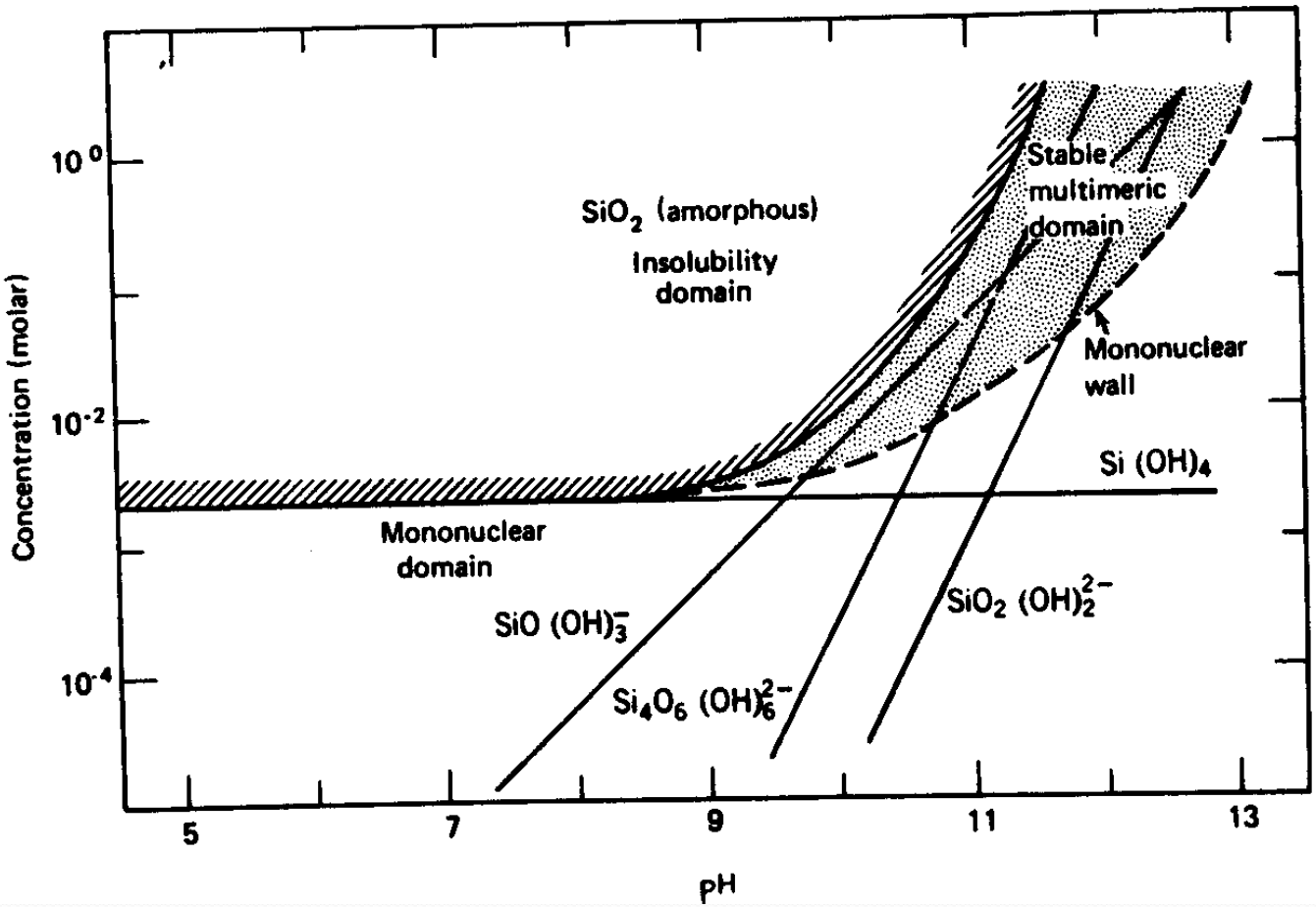
Chromium Hydroxide II



Stumm & Morgan, 1996, Figure 7.4, pg. 366

Aqueous Silica

- Thermodynamics
  - SiO_2 (s,quartz) + $2H_2O$ = $Si(OH)_4$ log K = -3.7
  - SiO_2 (s,am.) + $2H_2O$ = $Si(OH)_4$ log K = -2.7
  - $Si(OH)_4$ = $SiO(OH)_3^-$ + H^+ log K = -9.46
  - $SiO(OH)_3^-$ = $SiO_2(OH)_2^{-2}$ + H^+ log K = -12.56
  - 4 $Si(OH)_4$ = $Si_4O_6(OH)_6^{-2}$ + $2H^+$ + $4H_2O$ log K = -12.57



Stumm & Morgan, 1996, Figure 7.5, pg. 368

- To next lecture