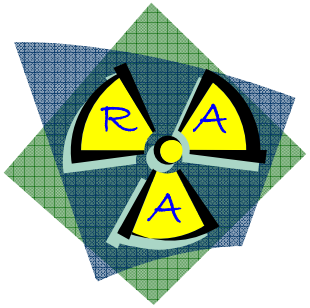
MINISTERIO DE EDUCACIÓN Y CIENCIA

Ciemat Centro de Investigaciones Energéticas, Medioambientales y Tecnológicas

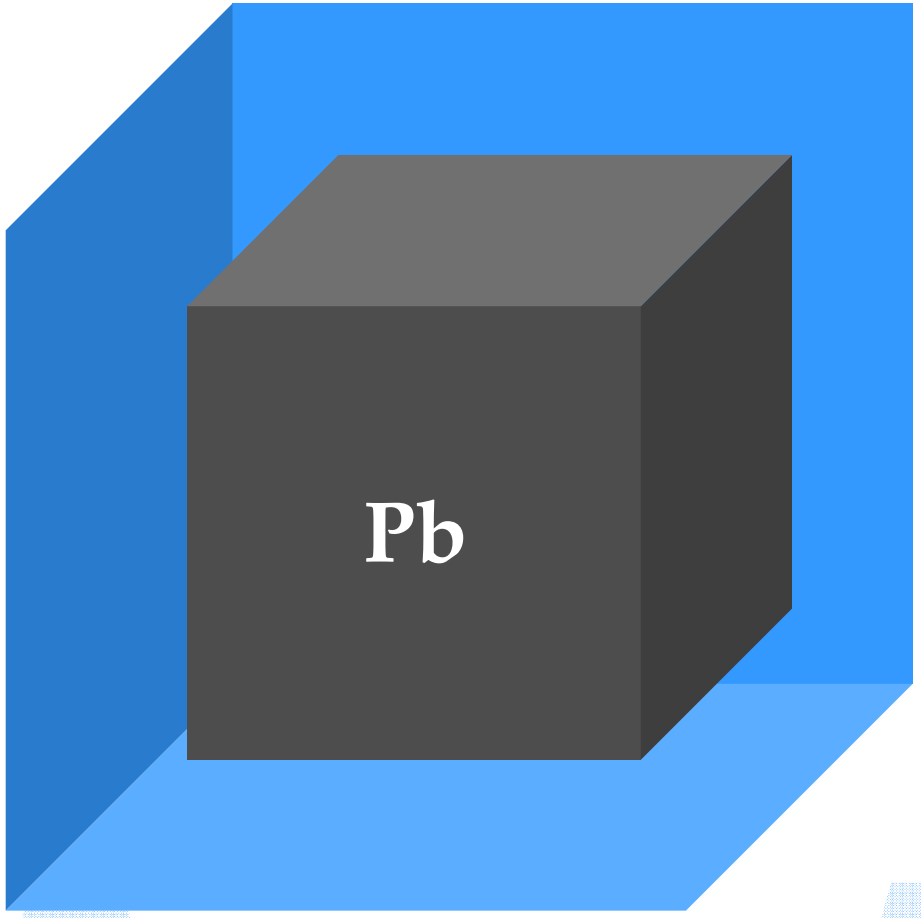
Pb corrosion modelling



Unidad de Residuos de Alta Actividad

System considered

- Pb
  - Cube
    - 0.8 x 0.8 x 0.4 m
  - Density
    - 11340 kg/m^3
  - Oxidation layer
    - 45 µm
    - 6.3 mol Pb oxide
- Volume H_2O
  - 500 l



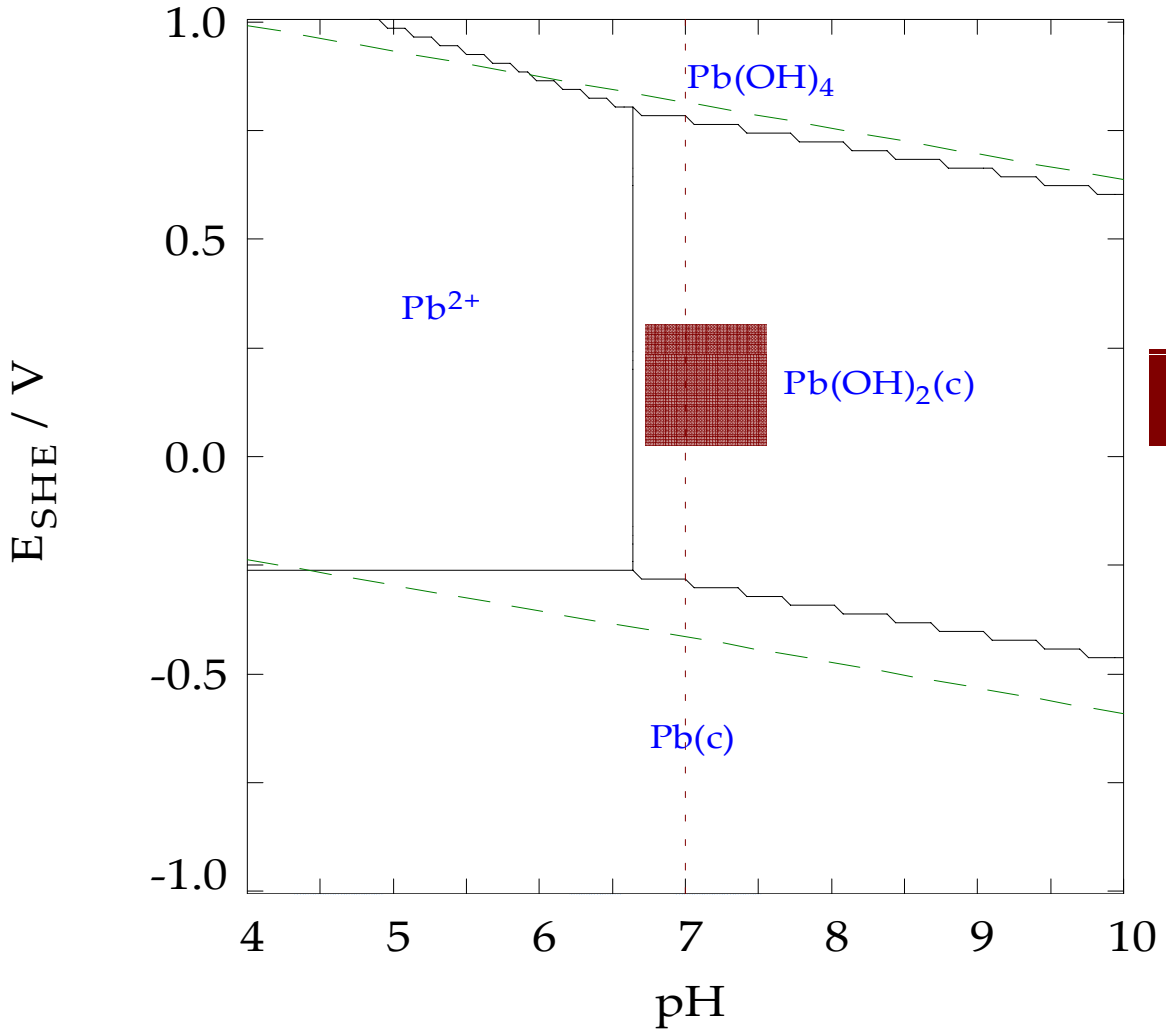
Modelling Steps and code used

- Equilibrium thermodynamic
  - $Pb + H_2O$
    - pH = 6
  - Diagram
    - Pourbaix diagram
    - Solubility
- Dry
  - Oxidation air
- Equilibrium thermodynamic
  - $Pb_{oxide} + Pb + H_2O$

- Codes used
  - Phreeqc Interactive 2.13.2
    - Solubility and speciation
  - MEDUSA
    - Predominance
    - Speciation
  - Data Base
    - Hydra v. 18
      - Hydrochemical Equilibrium-Constant Database)
        - Royal Institute of Technology
    - ASM International's Binary Alloy Phase Diagrams
      - Second Edition, Plus Updates on CD-ROM

1st step of working

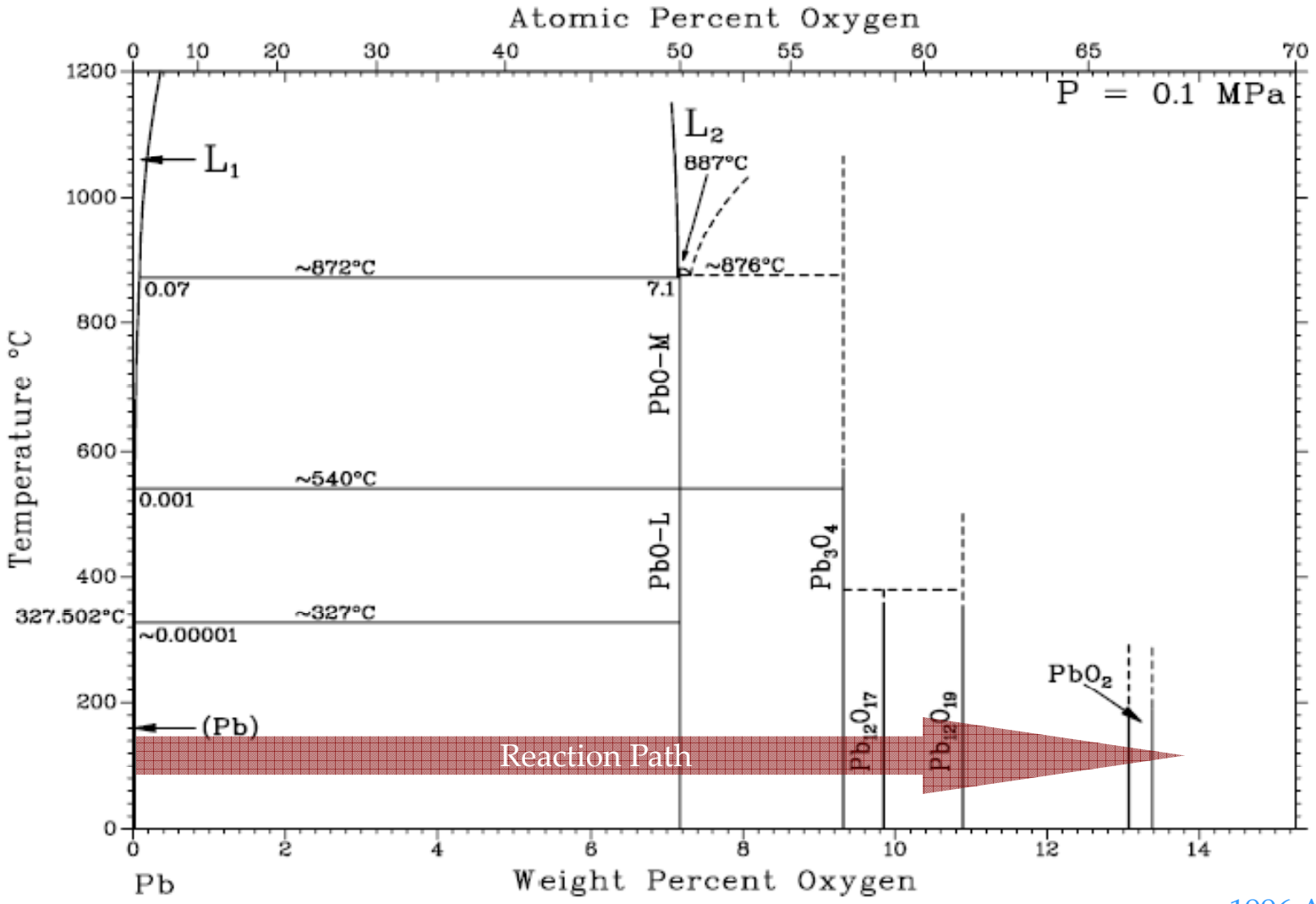
$[Pb^{2+}]_{TOT}$= 10.00 µM



$S_{Pb} = 2 \cdot 10^{-7}$ M

t= 25°C

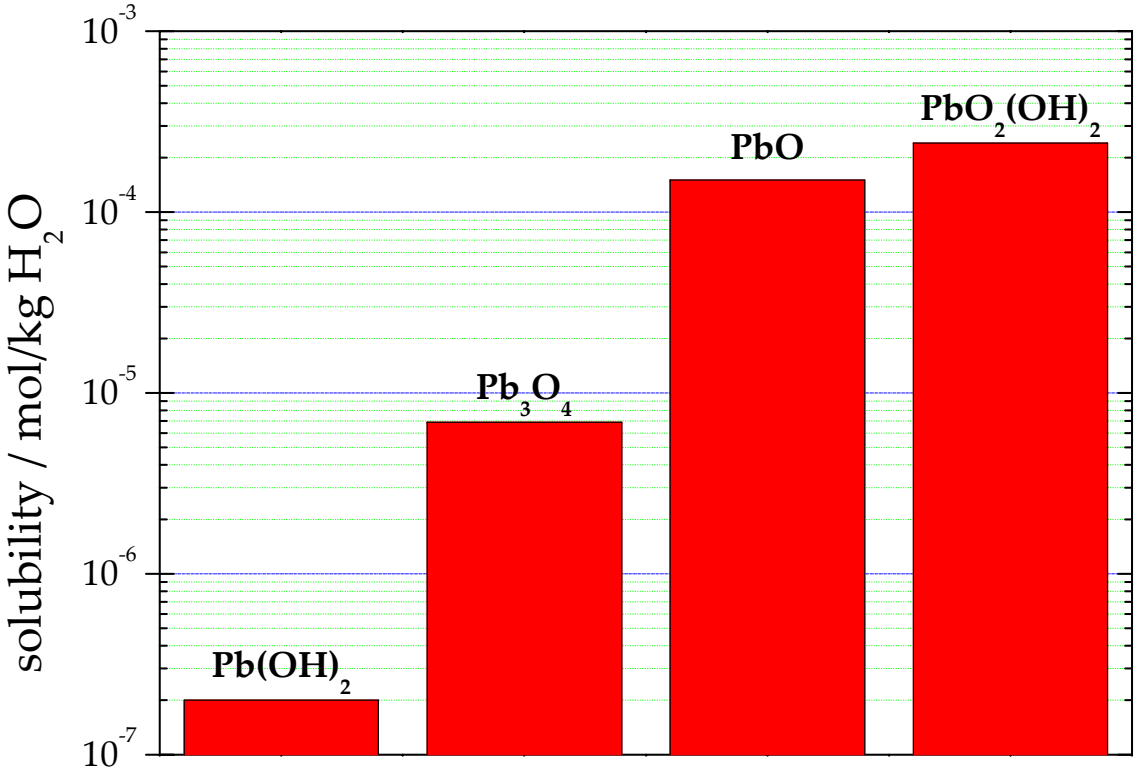
Air oxidation



1996 ASM

Pb oxide + Pb dissolution

- Pb + H_2O
  - $Pb(OH)_2$ → Equilibrium phase
    - Lowest oxidised
- Pb-oxide coat presence
  - Phase considered
    - Pb_3O_4
    - PbO
    - $PbO_2(OH)_2$
- These phase increase the solubility ➔ increase the amount of Pb sorbed by the resin



Pb solubilty in DIW

E_H = 0.30 V

$[Pb^{2+}]_{TOT}$ = 10.00 M