Hans-Henning Strehblow

Heinrich-Heine -Universität-Düsseldorf, Germany

Increase of Passive Current Density

1. Complexing Anions
   (organic or inorganic, halides)
2. Temperature
3. Accumulation of impurities,
   local deficiency of Cr
4. Radiation Damage
   (defects, implantations, voids)
5. Products of Radiolysis (H_2O_2 ?)
   Positive shift of potential-transpassive dissolution.

Localized Corrosion

a) Positive potential shift due to the occurrence of oxidants (H_2O_2 by radiolysis ?)
   Accumulation of aggressive anions due to wetting and drying periods.

c) Passivation transients at increased temperature to study the repassivation properties of surfaces. The stability of pit growth should be one of the most important questions. Pit nucleation will occur with time in any case.

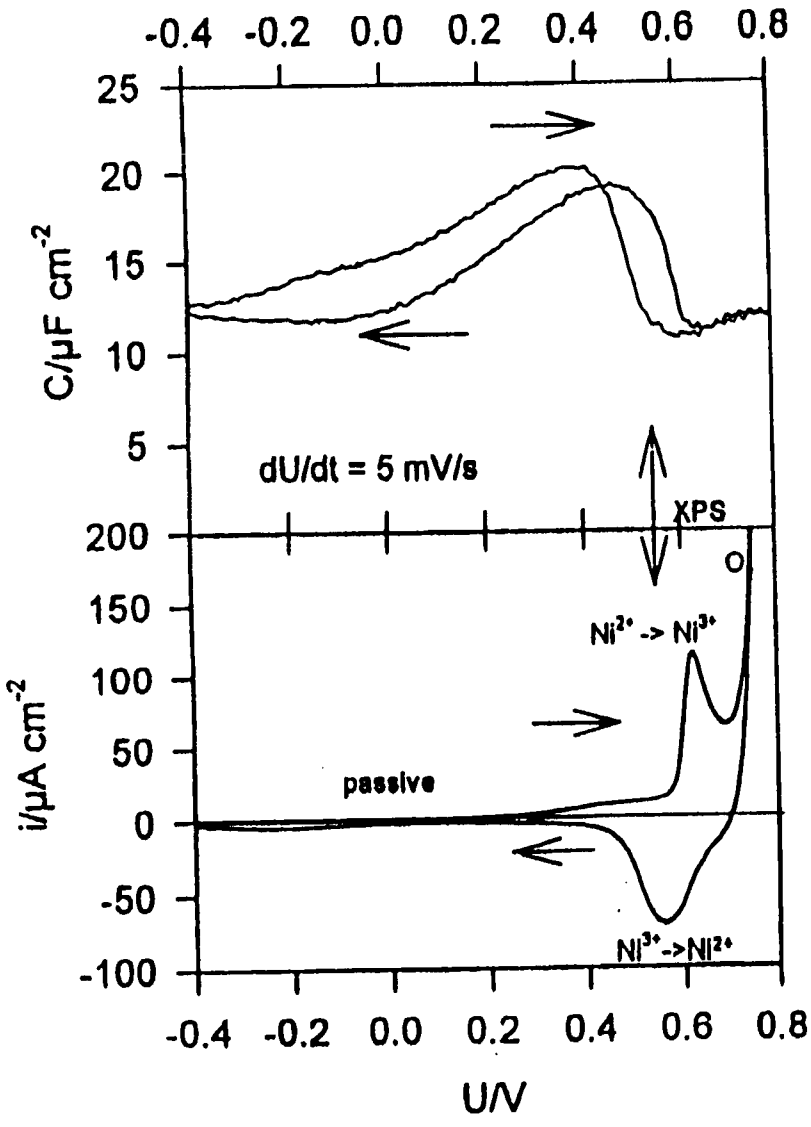
Hans-Henning Strehblow, Universität Düsseldorf

Passive Behavior of Ni-Cr Alloys

Cr is the most important component of Ni base Cr-Ni alloys due to its extremely low dissolution rate of Cr(III)-oxide in almost all aqueous environments within the passive range (below transpassivity). Cr(III)oxide protects also in strongly acidic electrolytes when it is far from its dissolution equilibrium. Pure Cr is neither attacked by general nor by localized corrosion due to its resistance to aggressive anions, especially to chloride, which is related to its special complexing properties. Self-healing of defects within the passive layer goes along with a reformation of Cr(III)-oxide. Ni hydroxide accumulates in alkaline solutions at the outer part of the passive layer, but dissolves in acidic solutions. XPS analysis of passive layers on Cr-Ni alloys yields a chemical structure which reflects the properties of these alloy components.

NaOH

a)



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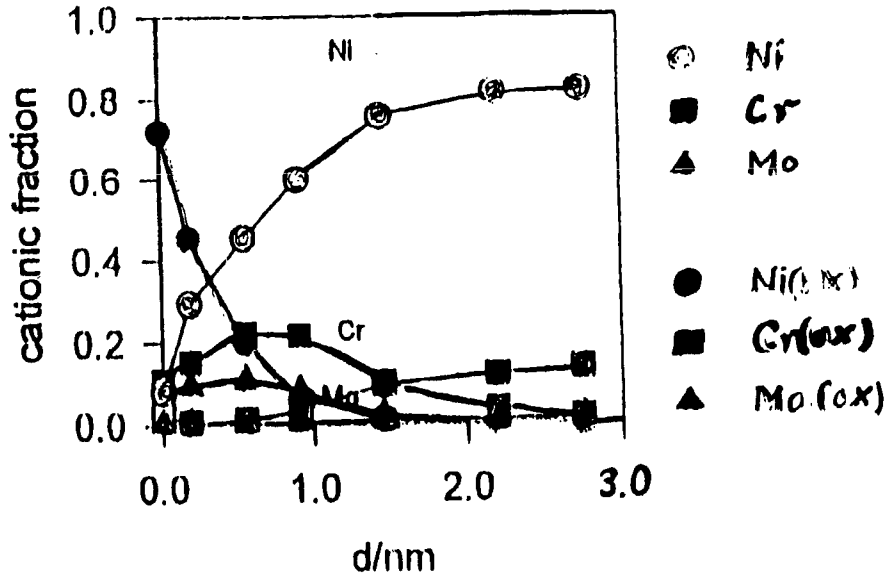

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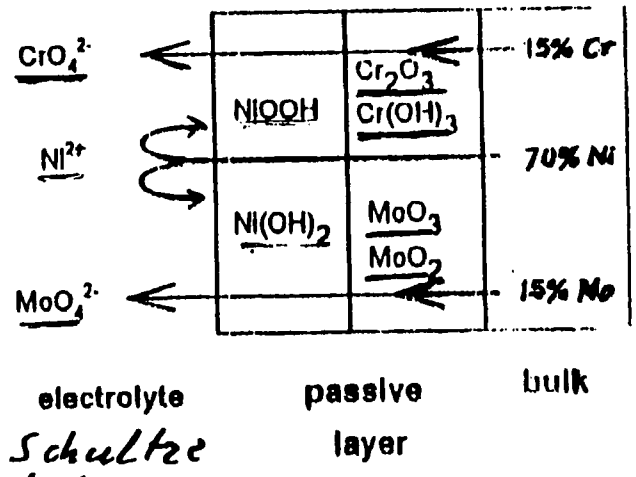
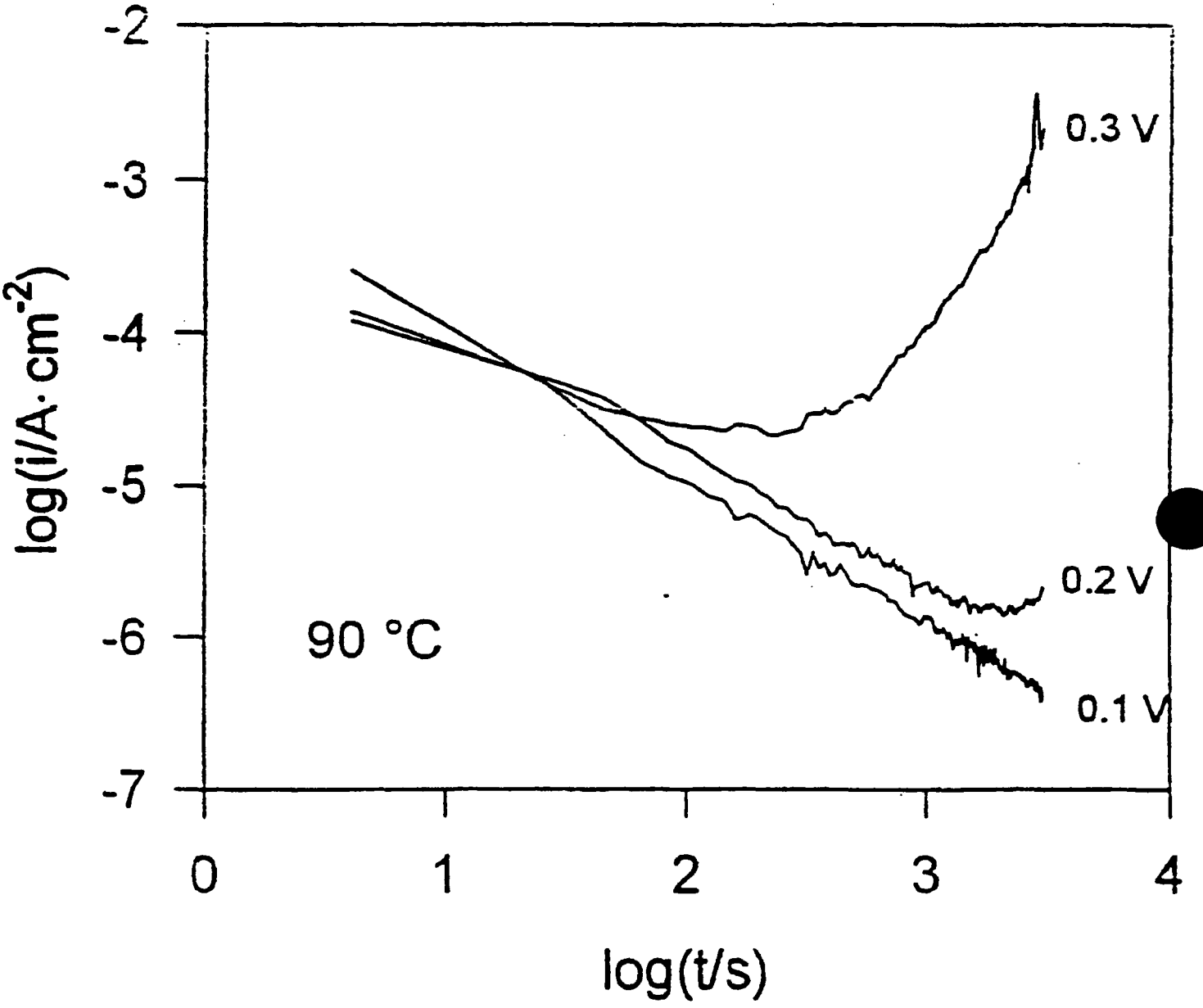


A. Thies, J.W. Schultze
Materials and Corrosion

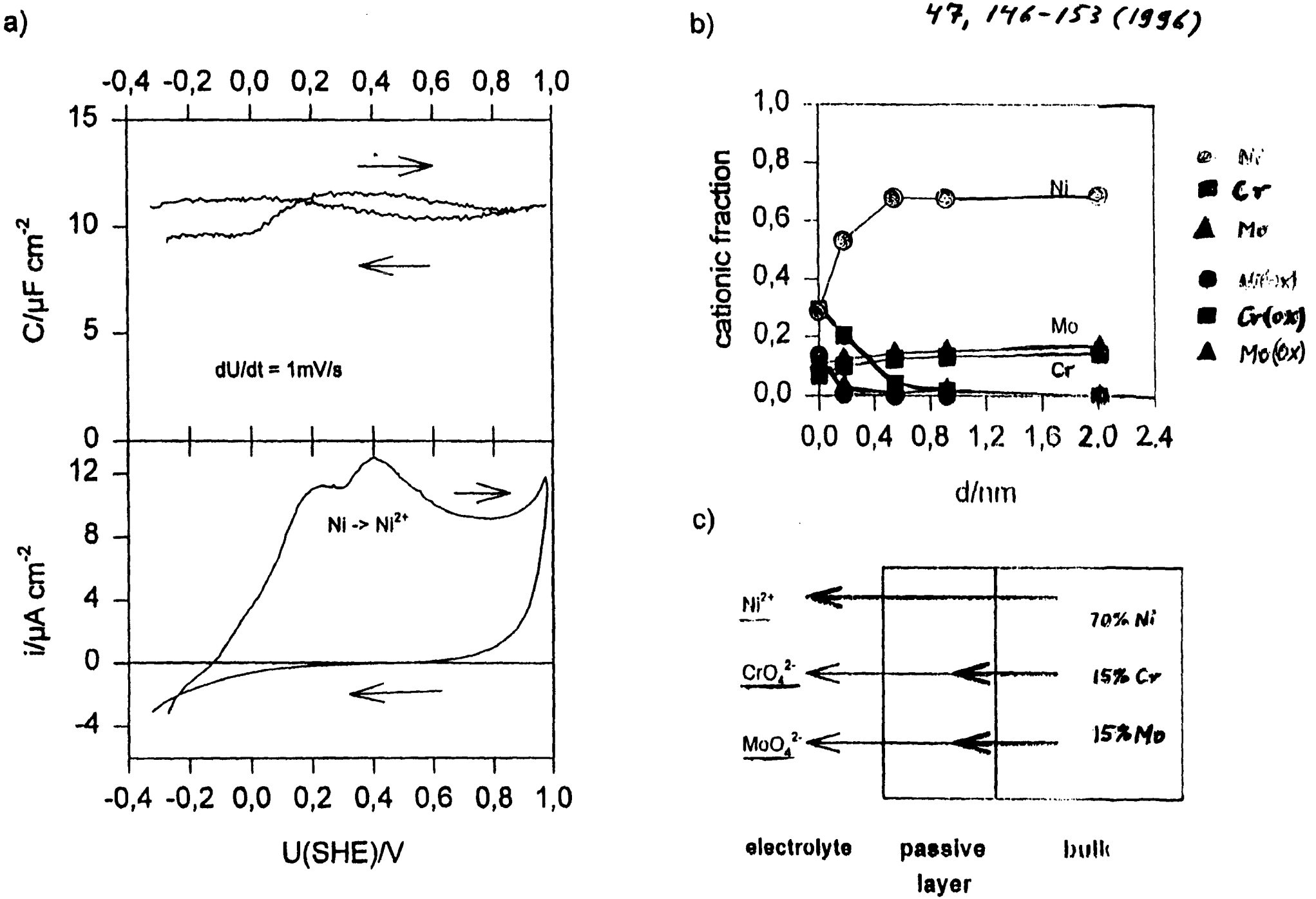


Passivation Transient of Hastelloy C4 in Q-brine, pitting at E > 0.2V

A. Thies, J.W. Schultze, Materials and Corrosion 47, 146-153 (1996)

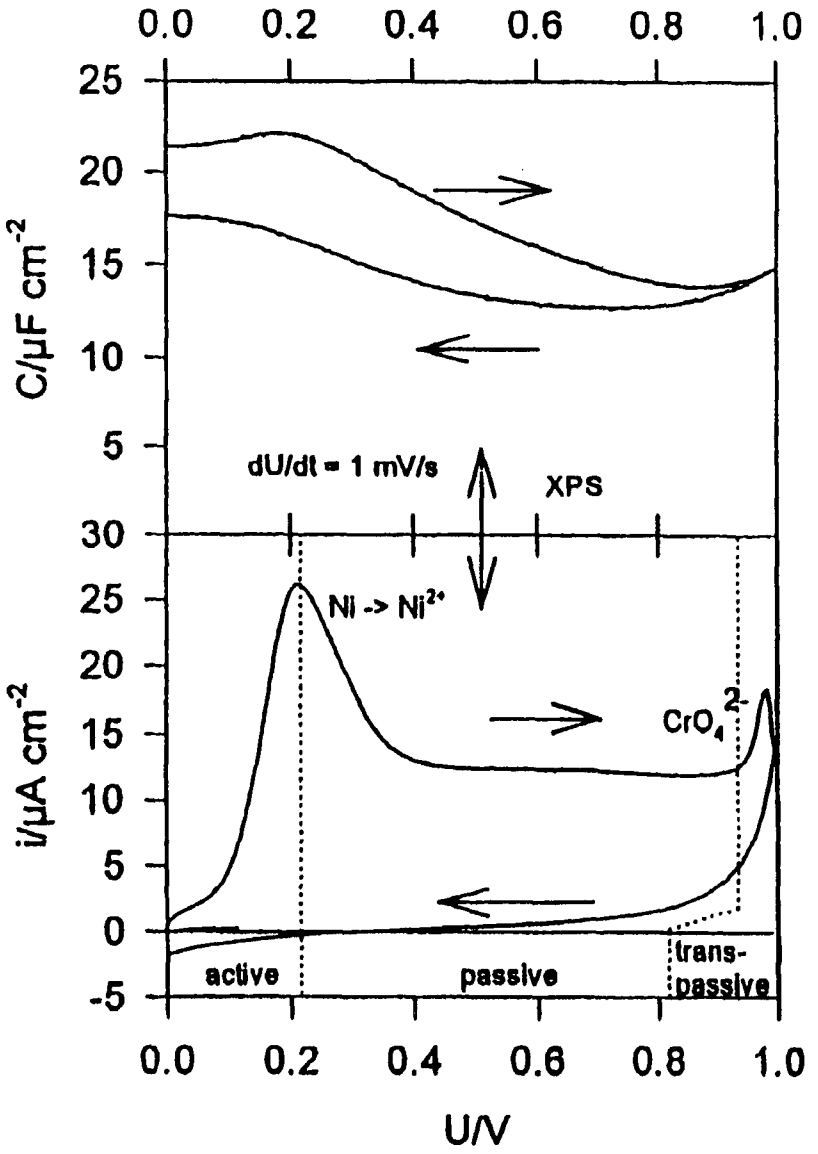
Q-brine, Hastelloy C4

A. Thies, J. [illegible] Schuetze
Materials and Corrosion
47, 146-153 (1996)

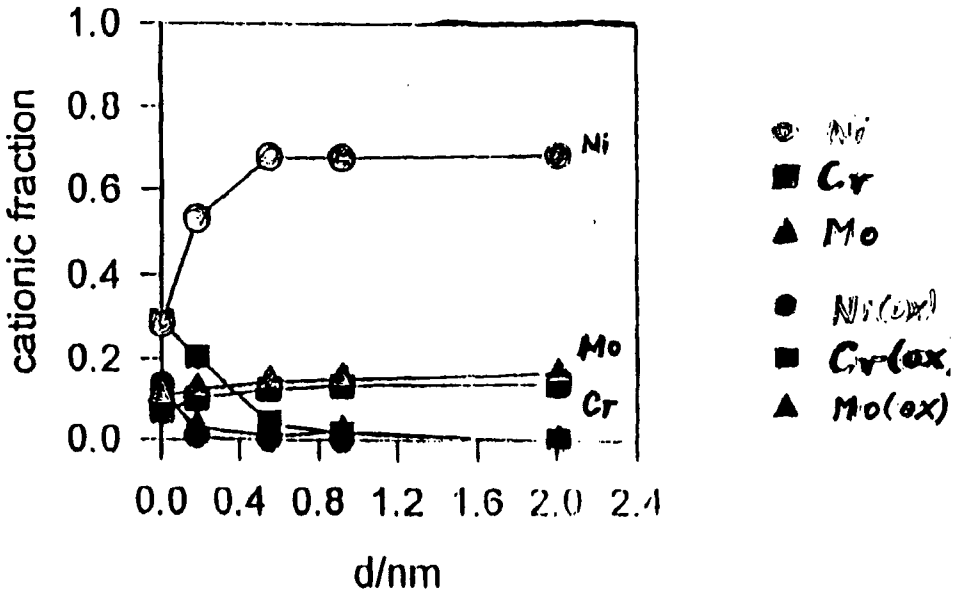


0.5M H_2SO_4 25°C

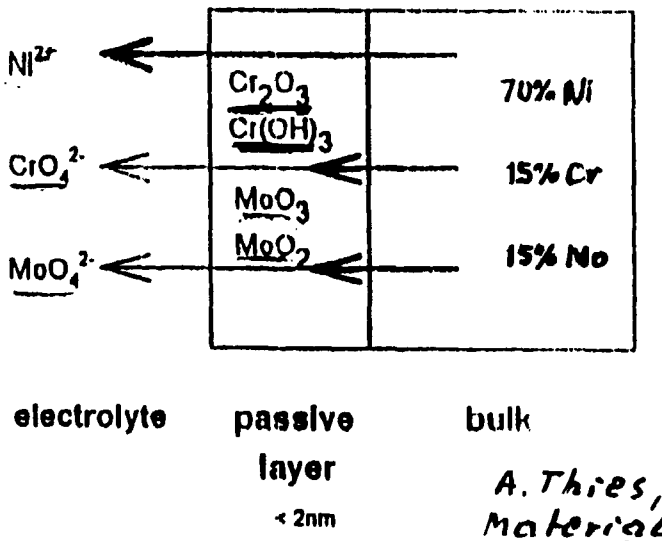
a)



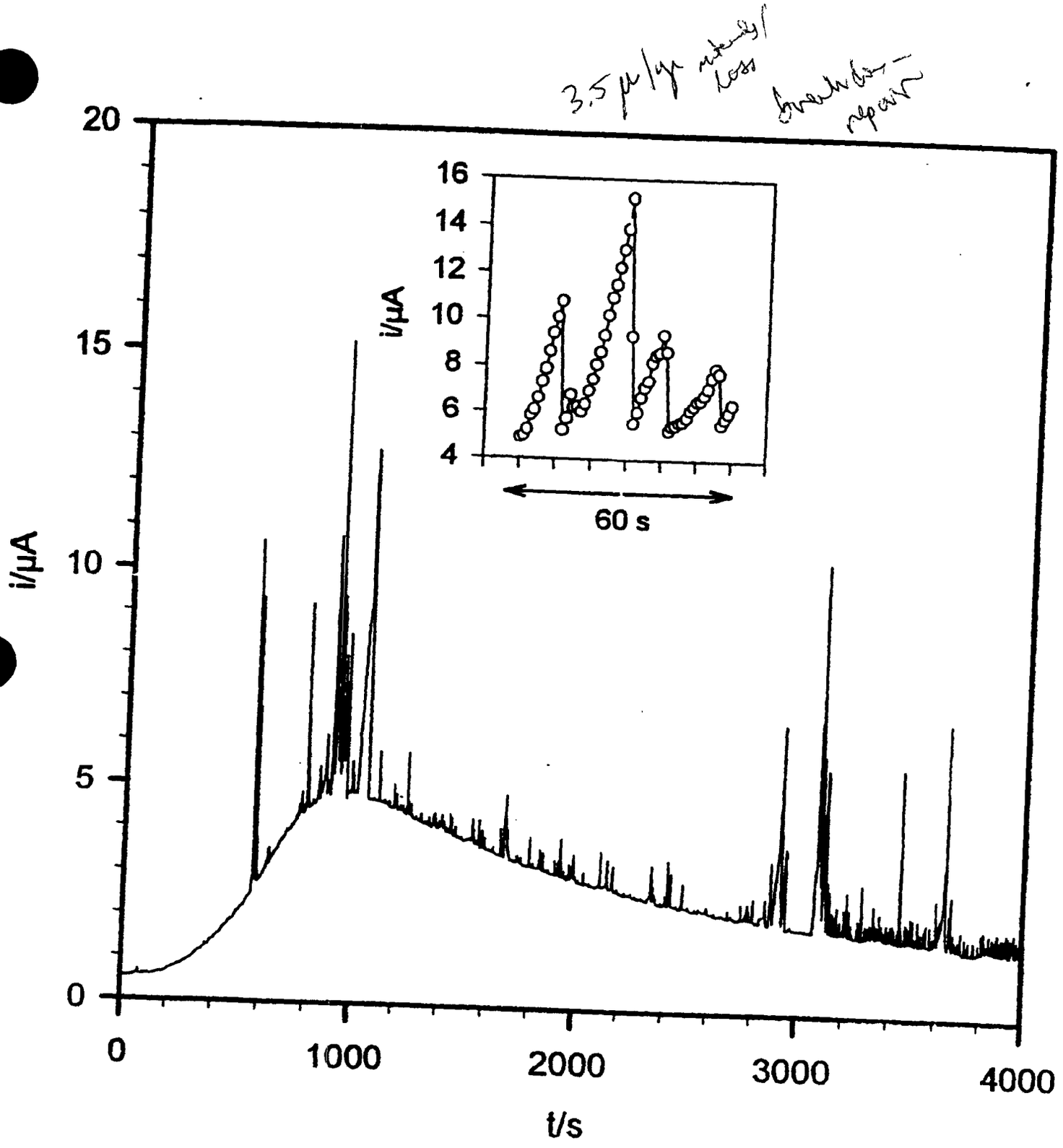
b)



c)

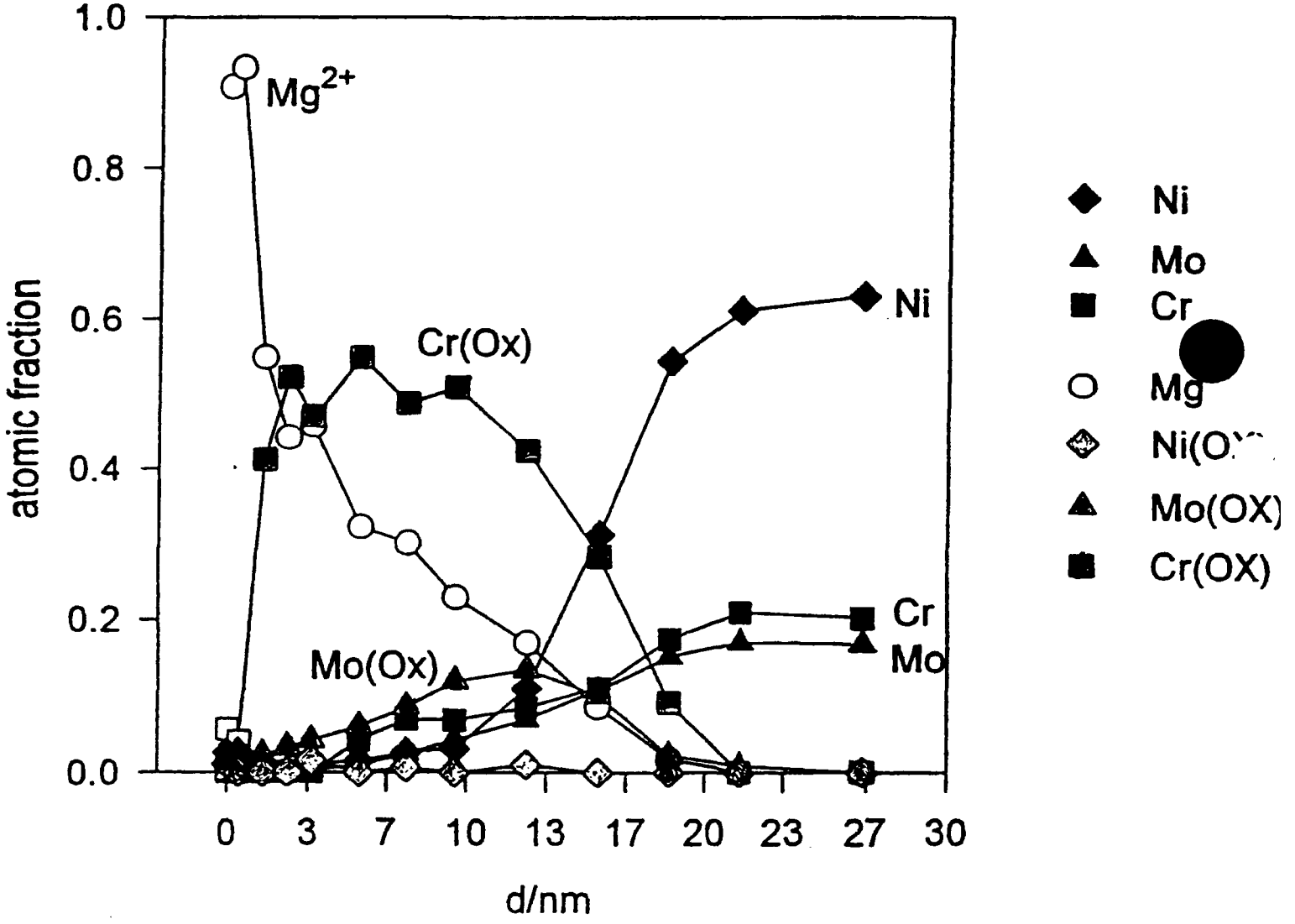


A. Thies, J.W. Schultze
Materials and Corrosi
47, 146-153 (1996)



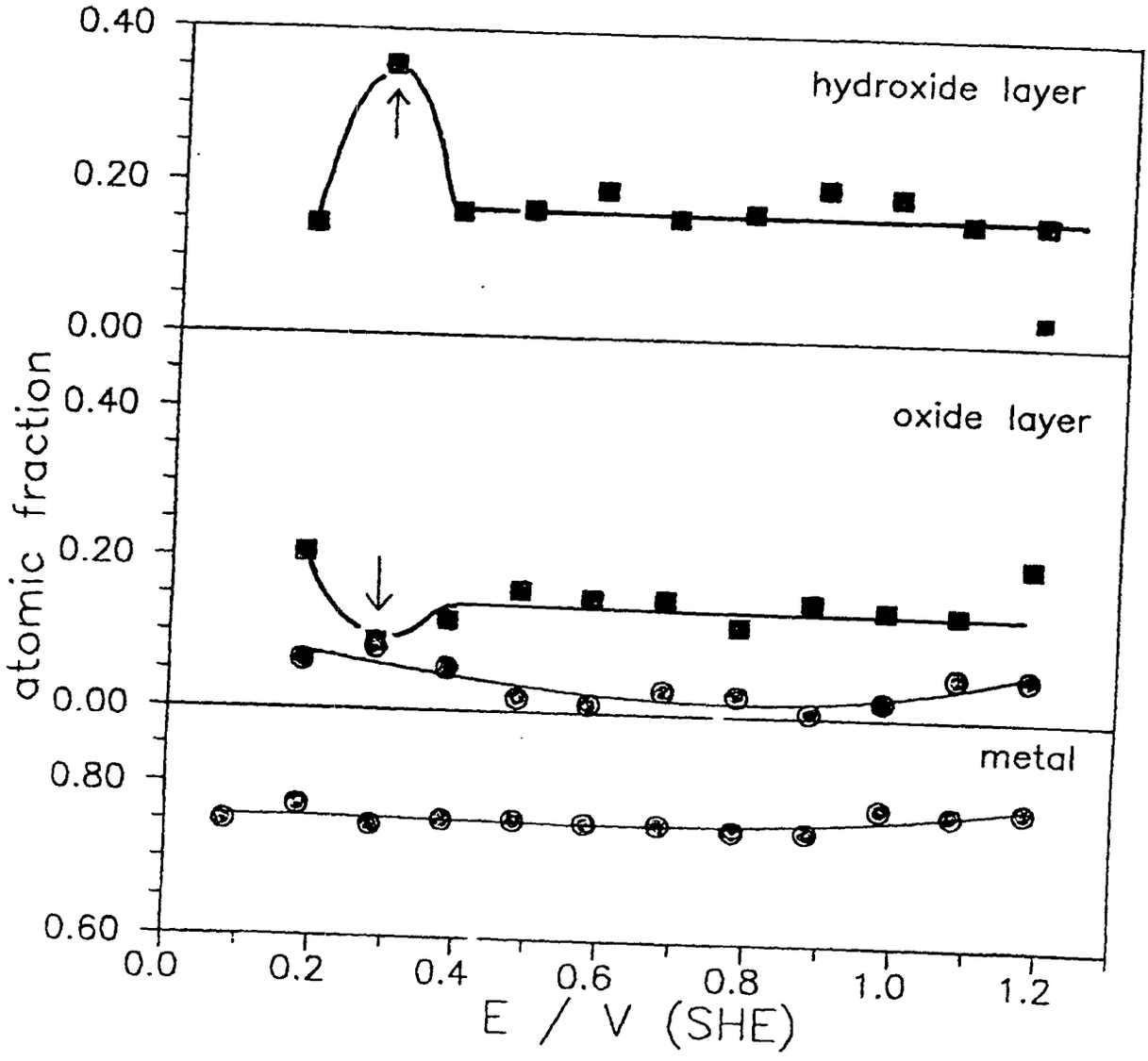
Hastelloy C4: Q-brine, E = 0.5 V
pitting transients

A. Thiers, J. W. Schultze
Materials and Corrosion 47, 146-153 (1996)

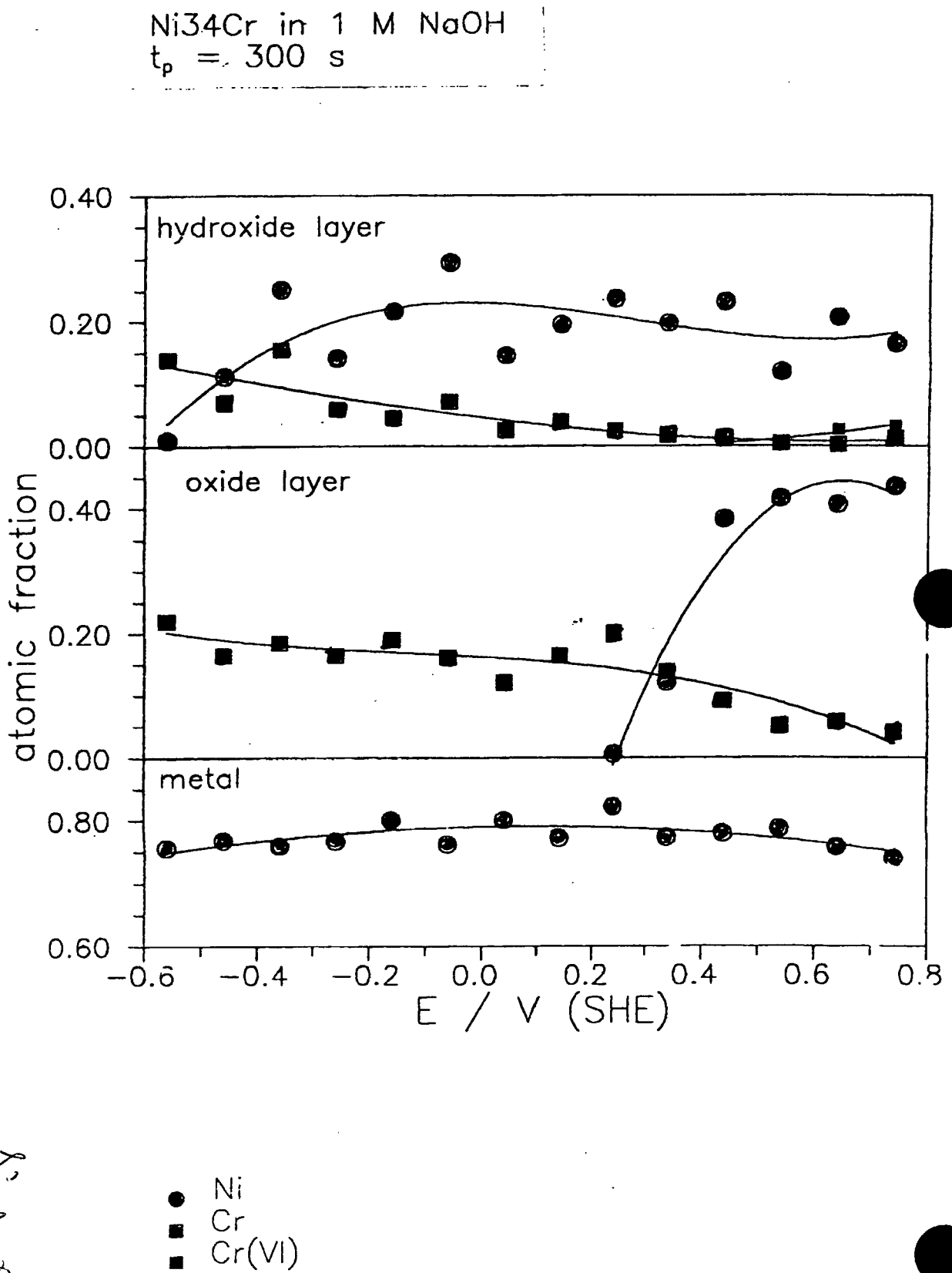


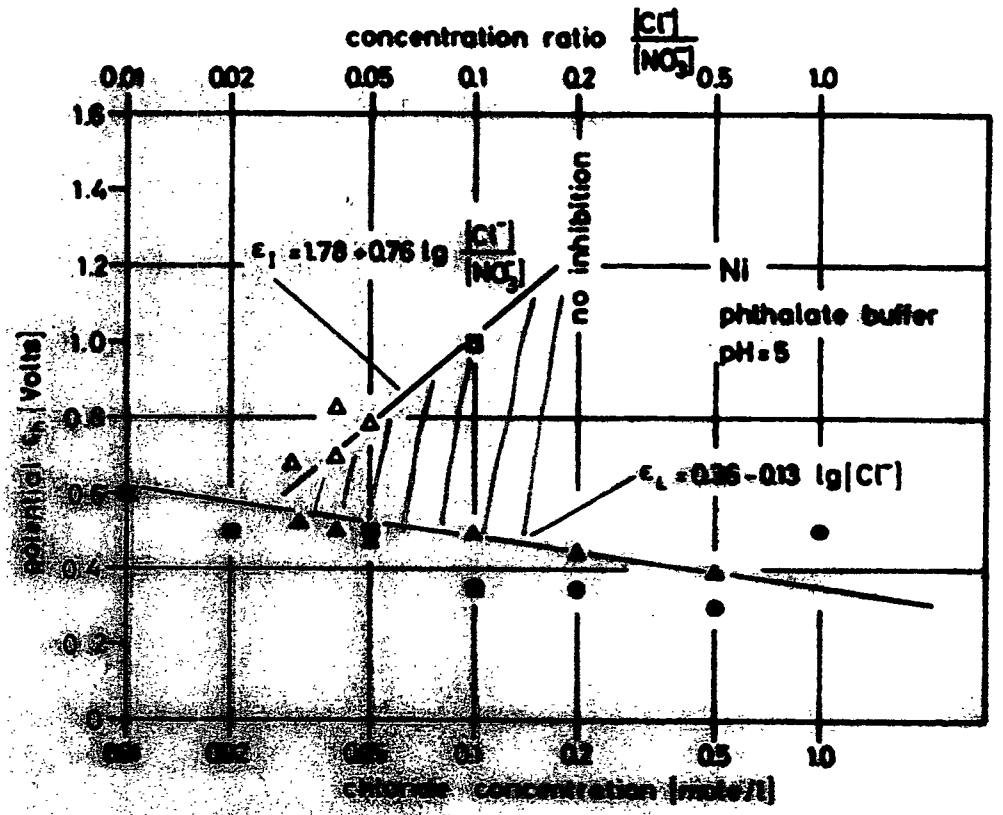
Hastelloy C4, 4days Q brine, 200°C
sputter profile
A. Thies, J. W. Schultze
Materials and Corrosion
47, 146-153 (1996)

Ni34Cr in 0.5 M H_2SO_4, t_p = 300 s



Ni
Cr
Cr(VI)


Ni34Cr in 1 M NaOH
t_p = 300 s
hydroxide layer
oxide layer
metal
atomic fraction
0.40
0.20
0.00
0.40
0.20
0.00
0.80
0.60
−0.6
−0.4
−0.2
0.0
0.2
0.4
0.6
0.8
E / V (SHE)
Ni
Cr
Cr(VI)



STREHBLOW 7/20/01