



HAL
open science

Corrosion behavior of iron in cementitious solution at 80°C in anoxic condition

D. Pally, B. Grenut, F. Miserque, L. Chomat, V. L'Hostis, P. Le Bescop

► **To cite this version:**

D. Pally, B. Grenut, F. Miserque, L. Chomat, V. L'Hostis, et al.. Corrosion behavior of iron in cementitious solution at 80°C in anoxic condition. EUROCORR 2018, Sep 2018, Cracovie, Poland. cea-02339320

HAL Id: cea-02339320

<https://cea.hal.science/cea-02339320v1>

Submitted on 14 Dec 2019

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

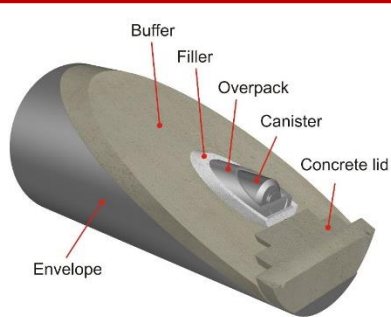
Corrosion behavior of iron in cementitious solution at 80°C in anoxic condition

D. Pally¹, B. Grenut¹, F. Miserque², P. Le Bescop¹, L. Chomat¹, V. L'Hostis¹

¹ Den-Service d'Etude du Comportement des Radionucléides (SECR), CEA, Université Paris-Saclay, F-91191, Gif-sur-Yvette, France

² Den-Service de la Corrosion et du Comportement des Matériaux dans leur environnement (SCCME), CEA, Université Paris-Saclay, F-91191, Gif-sur-Yvette, France

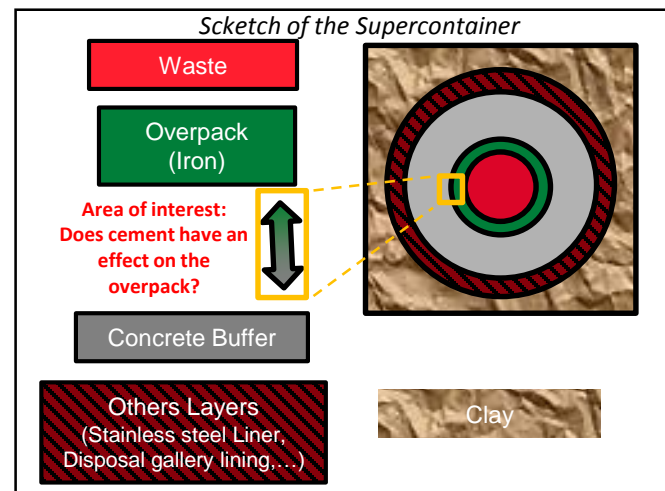
Context



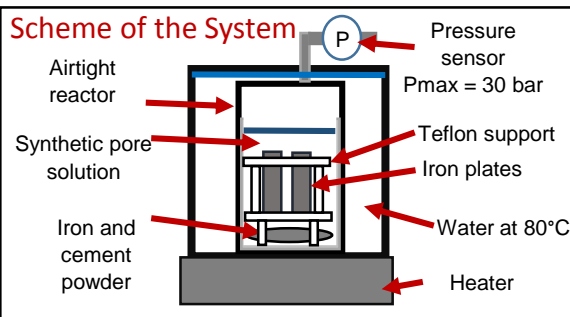
The Belgian reference concept for high-level radioactive waste packaging proposed by ONDRAF/NIRAS is called « Supercontainer ».

Inside the container, a concrete buffer allows to maintain high alkaline conditions at the surface of the overpack. → a passive film should form on the iron surface (in anoxic condition and 80°C),.

→ Aim of this study : Characterize the passive layer and its stability over time



Experimental device



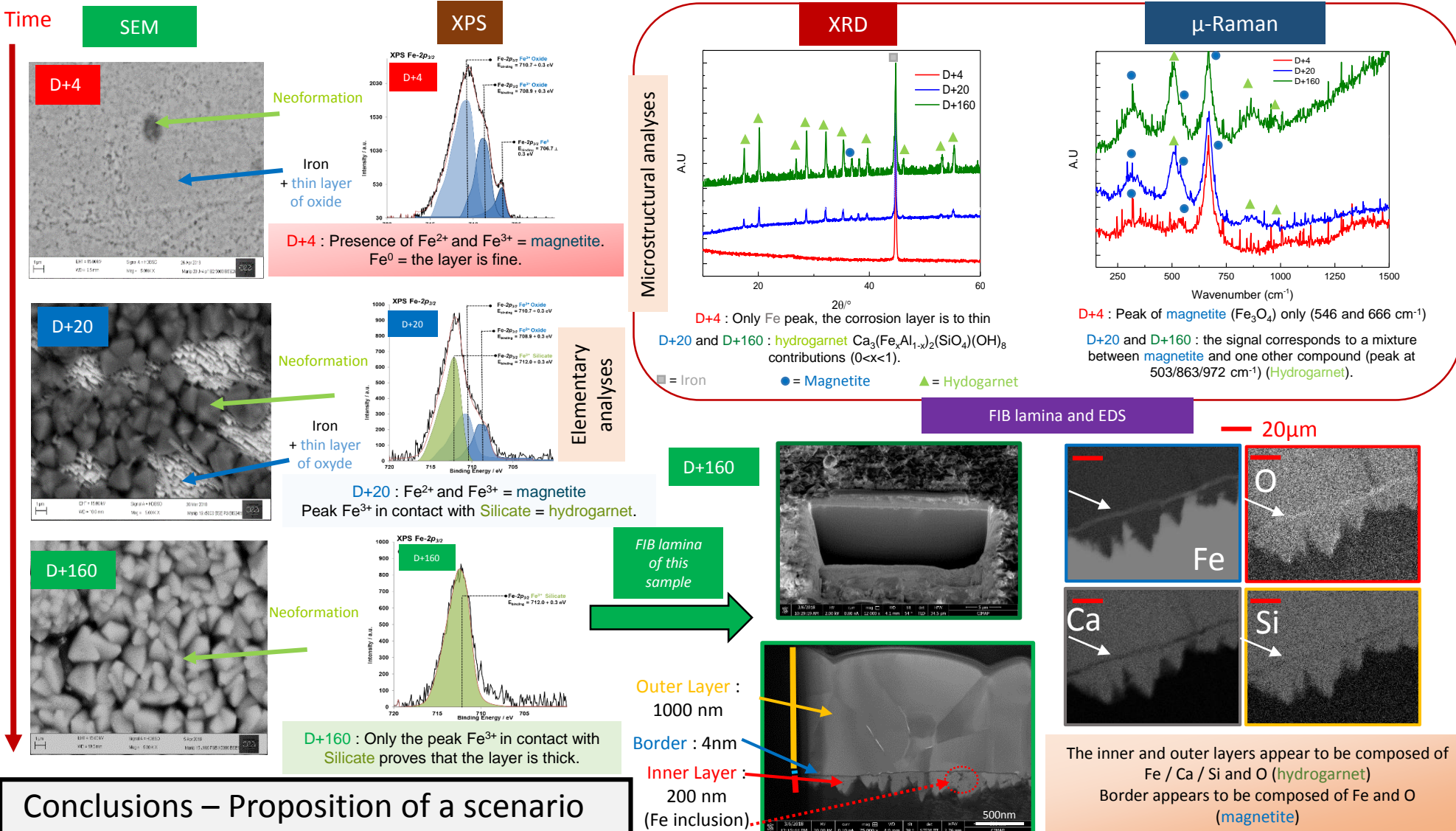
N°	Cementitious material	Corrosion days	Temperature (°C)
Fe D+4 days	CEMI	4	80
Fe D+20 days	CEM I	20	80
Fe D+160 days	CEM I	160	80

Corrosion parameters

Solution :
NaOH = 63 mmol/l + KOH = 139 mmol/l
(Alkaline solution pH 13.2)
+ Cementitious material
(CEM I powder hydrated)

Anoxic condition, 80°C

Results / Characterization



Conclusions – Proposition of a scenario

In our conditions (Alkaline solution with cement powder/80°C/anoxic conditions):

- First days : Formation of magnetite
- After several days : Formation of Hydrogarnet $Ca_3(Fe_xAl_{1-x})_2(SiO_4)(OH)_8$
- Presence of Inner and outer layer composed of Hydrogarnet
- Presence of central layer composed of magnetite

Perspectives

- 1° Determination of the formation condition of the hydrogarnet layer
 - Influence of chemical conditions (effect of aluminum and silicon)
 - Influence of pre-corroded surfaces
- 2° Ability of neoformations to inhibit pitting corrosion
 - Chlorides influence