



HAL
open science

Influence of iron corrosion on nuclear glass alteration processes: nanoscale investigations of the iron-containing phases

Charly Carrière, Lucile Gentaz, Delphine D. Neff, Florence F. Mercier-Bion, Eddy A Foy, Christelle Martin, James J Dynes, Muriel Bouttemy, Arnaud Etcheberry, Philippe Dillmann

► **To cite this version:**

Charly Carrière, Lucile Gentaz, Delphine D. Neff, Florence F. Mercier-Bion, Eddy A Foy, et al.. Influence of iron corrosion on nuclear glass alteration processes: nanoscale investigations of the iron-containing phases. Eurocorr 2016, Sep 2016, Montpellier, France. cea-02331802

HAL Id: cea-02331802

<https://hal-cea.archives-ouvertes.fr/cea-02331802>

Submitted on 24 Oct 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.

Several strategies propose to store and confine High Level Radioactive Waste in a deep geological disposal. Andra (French National Radioactive Waste Management Agency) suggests a multi barrier system including the glass canister, a carbon steel overpack and a low permeability clay host rock to prevent borosilicate glass alteration and to limit migration of radionuclides released under the action of water. However after thousand years and resaturation of clay, water will corrode the carbon steel overpack causing the release iron ions and precipitation of iron carbonates as corrosion products. The glass matrix will alter through glass hydrolysis and release silicon in solution. Thus, neoformed Fe-Si-O phases can precipitate in the glass alteration layer (GAL) or at the outer part of the GAL and lower the concentration of Si in solution, increasing glass dissolution. Consequently identification and characterization of nanocrystallized Fe-Si-O phases is crucial for modelling the mechanism of glass alteration in contact with iron.

The results presented here are obtained on samples (mix of nuclear glass and iron powder) altered in the underground Laboratory of Bure (France). Nanoscale investigations (Transmission Electron Microscopy and Scanning Transmission X-Ray Microscopy) show presence of neoformed nanocrystallized phases (iron silicates) inside GAL and on the iron corrosion products (CP). Several families of structured Si-Fe-O phases are identified (e.g. smectite, chlorite, serpentine) according to the localization and the valence of iron in CP.

REFERENCE: Dillmann P. *et al*, (2016) Effect of natural and synthetic iron corrosion products on silicate glass alteration processes. *Geochimica et Cosmochimica Acta* 172, 287-305.