AQUEOUS ALTERATION OF CR CHONDRITES AS ANALOGUE FOR CORROSION PROCESSES: FIRST FIB/TEM RESULTS. A. Morlok[1,2] [3]H. Leroux [4]D. Troadec G. Libourel[1] [1]CRPG-Nancy Université-INSU-CNRS, UPR2300, BP 20, 54501 Vandoeuvre-lès-Nancy, France. [2]ANDRA-DS/CM, 1/7 rue Jean Monnet, 92298 Châtenay-Malabry France. amorlok@crpg.cnrs-nancy.fr [3] Laboratoire de Structure et Propriétés de l'Etat Solide 59655 Villeneuve d'Ascq, France [4]IEMN 59652 Villeneuve S`Asqe, France

Introduction: In France, fission products and minor actinides resulting from the reprocessing of nuclear spent fuel are incorporated in a nuclear boro-silica glass in steel containers. The waste material has to be stored safely for a time frame of at least 10^5-10^6 years in a clay-rich geological repository.
The long term evolution of these materials in laboratory is difficult to simulate. As analogues, CR chondrites are used, since they contain abundant metal grains which underwent corrosion over long time periods [1].

Since CR chondrites show alteration over the whole range from type 3 to 1, they allow the investigation of all alteration steps [2, 3]. The physico-chemical environment of the parent body during the alteration is sufficiently similar to that expected in the disposal facility with a temperature range of 50-150°C, Water/Rock ratios of 0.4-1.1 and low fO_2 [1-4]. Earlier parts of these studies based on SEM, EMPA, and RAMAN analyses already show the development of a corrosion sequence around metal in chondrules and metal grains mainly consisting of magnetite and sulfide [5-7].

Here we show first results of TEM analyses of samples cut from the most interesting spots from Rennazzo and Al Rais (CR2) and GRO 95577 (CR1). The samples have been prepared by FIB (focused ion beam) technique and studied by TEM at the University of Lille.

Techniques: To cut small slices of materials from the bulk samples, a FEI Strata DB 235 FIB/SEM at Lille University was used. Following a standard procedure, the area of interest was protected by ion beam platinum deposition before milling sample and lift out TEM lamela by in-situ micromanipulator to stick on specifical TEM grid. The resulting slices were analyzed with TEM and EDS at Lille University.

Results: EDS analyses on spots of two samples covering the extensive corrosion rim (50 microns thick) around a metal grain in contact with the phyllosilicate-rich matrix in Al Rais confirm the earlier results from EMPA and Raman measurements [5-7]. The TEM analyses show that the metal grain is surrounded by several sequences of alternating magnetite/sulfide rims. Also the occurrence of Ca-phosphates an outer (older) magnetite layer is confirmed. However, diffraction patterns indicate that most of the corrosion layers are not homogenous, as SEM images suggest. They are very fine grained mixtures of several phases. Magnetite dominated rims usually have significant contents in S or Si/Mg, indicating smaller amounts of sulfides and silicates. Sulfide-rich areas also show Si/Mg, but also O contents.

References: [1] Weisberg et al. 1993 *Geochimica et Cosmochimica Acta* 57, 1567 [2] Abreu 2007, PhD thesis [3] Weisberg M.K. and Huber H. 2007 *Meteoritics & Planetary Science* 42:9, 1495 [4] Zolensky, M. et al. 1993 *Geochimica et Cosmochimica Acta* 57, 3123 [5] Morlok and Libourel 2008 *Meteoritics & Planetary Science* 43:7, A104 [6] Morlok and Libourel 2008 *Meteoritics & Planetary Science* 43:7 [7] Morlok et al. 2009 Abstract #1296, 40th Lunar & Planetary Science Conference.