International Conference on Radioactive Waste Management: Solutions for a Sustainable Future
1–5 November 2021, Vienna, Austria

Contribution ID: **251**

Type: **POSTER**

Can Al and Zn simulate the Be chemical behavior in aqueous solution and cementitious matrices?

In future experimental fusion ITER facility, beryllium (Be) constitutes the main first wall plasma-facing material. ITER will then produce Be waste, either in the solid or in powder form. It is important to anticipate the management of the generated radioactive waste. To manage Be, direct immobilization in a cementitious matrix seems to be an option. A research project has then been undertaken to select the best matrix for a safety storage of Be.
Nevertheless, Be powder is known as carcinogen and it can cause a respiratory disease, the berylliosis. It then seems interesting to find a surrogate to understand the Be reactivity without handling it. Our work focuses on comparing the reactivity of massive Be with its known substitutes Al and Zn to find the proper surrogate for prospective powder experiments.

Thermodynamic data on the stability of Al and Zn in water at 25℃ are known: their passivation zone is respectively between pH 3-10.5 and pH 7.5-13 and they corrode into ionic species bellow and above these pH. On the contrary, the calculated data for Be reported in the literature differ especially in basic media: calculations of Pourbaix predict an aqueous corrosion of Be starting at pH 10.5 while recent studies shows a corrosion above pH 13.5.
Owing to the incertitude of thermodynamics for Be, the conditioning of metals (Be, Al and Zn) have been studied in 5 cements with different interstitial pH: brushite, magnesium phosphate cement, calcium sulfo aluminate cement, portland cement and activated slag. The pore solution pH of these matrices ranges from very acid to very basic values. Corrosion studies have been also made in aqueous solutions in a wide range of pH (HCl-NaOH solutions). The metal reactivity is followed mainly by electrochemical impedance spectroscopy in both solutions and cements.

Corrosion measurements on Al and Zn are consistent with the literature for both solution and cement experiments. Results on Be can confirm thermodynamics: Be is corroded at low pH with production of hydrogen gas (brushite cement) and Be is stable in cement having a neutral pH pore solution (magnesium phosphate cement) like Al. However, the electrochemical experiments in alkali solutions and cements having a basic pore solution are in agreement with the most recent thermodynamic data: Be seems to be protected against the corrosion by a stable protective layer in a pH range from 10 to 13 but strongly corrodes in high alkalis cement (slag) like Zn.

Do you wish to participate as a Young Professional?

Yes

Speaker's title

Ms

Affiliation

CEA

Do you wish to be considered for a Young Professional grant?

Not specified

Primary author: Ms BOUHIER, Pauline (CEA, CNRS)

Co-authors: Dr CANNES, Céline (CNRS); Dr LAMBERTIN, David (CEA); Dr GRISOLIA, Christian (CEA); Dr DELPECH, Sylvie (CNRS)

Presenter: Ms BOUHIER, Pauline (CEA, CNRS)

Session Classification: Solutions for Specific Wastes

Track Classification: 3. Solutions for Specific Wastes