



PREDIS

WP4: Innovations in metallic materials treatment and conditioning

T6 : Encapsulation of reactive metals in magnesium phosphate cements based matrices

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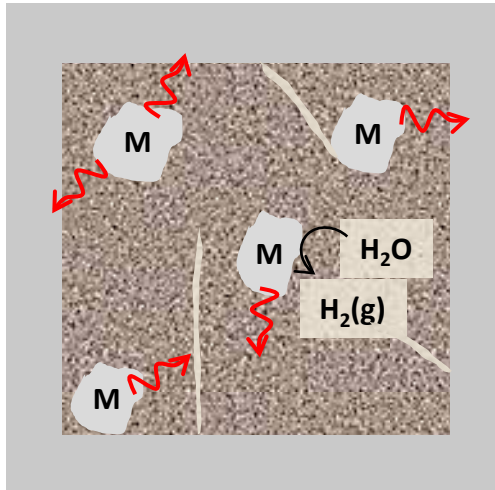
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Context



**conventional
cementitious
matrices based
on Portland
cement**

Modest cost

Easy implementation of the cement

Good mechanical strenght

Acceptable resistance to irradiation

Good stability of the cement over time

Pore solution with a high pH

allowing the precipitation of many radionuclides on hydroxyde form.

Benefits

Drawbacks

**But causing the corrosion of some metal
radioactive waste (Al, Be)**

- M: Low and intermediate level metal radioactive waste
- Conditioning in a cementitious matrix
- Container: steel or concrete

➡ Need to propose an acceptable alternative to the Portland cement for specific metal waste

Objectives

Al radioactive waste

Al (metal or alloy) is produced during the dismantling of old reactors.

Al is oxidized into $\text{Al}(\text{OH})_4^-$ or AlO_2^- in basic media, while a protective oxide layer is formed in the pH range 4 – 9.

First results have shown a significant decrease of the corrosion rate in magnesium phosphate cements.

Be radioactive waste

Metal Be constitutes the heart of the Belgian Reactor 2 and Be waste will be produced by the future ITER fusion facility.

There is a lack of data on the Be reactivity in cementitious media.



To fill an important gap on the management of LL and IL metal radioactive waste (having high reactivity in high pH media) by proposing magnesium phosphate cements as alternative systems to the conventional Portland systems.

Guidelines of the study

Magnesium phosphate cements (MPC)

New cement under consideration for conditioning the radioactive metal waste. Need to acquire more detail data on MPC under storage conditions (irradiation, leaching, metal waste corrosion).

Studies are carried out on cements prepared with high-quality reagents.

Need to decrease the price of these cements to use them at the industrial scale (diminish the quality of the reagents for the proposed formulation to encapsulate Al waste or increase the amount and the type of the filler).



- Provide guidance on matrix formulation based on WAC and economical considerations.
- Evaluate the behavior of magnesium phosphate based matrix under leaching or irradiation.
- Provide a set of experimental data on Al and Be corrosion in magnesium phosphate cements, including the volume of hydrogen generated.
- Evaluate the reactivity of the steel envelop of the primary package in contact with MPC.