Accepted Manuscript

Influence of formulation parameters of cement based materials towards gas production under gamma irradiation

D. Chartier, J. Sanchez-Canet, L. Bessette, S. Esnouf, J.-P. Renault

PII: S0022-3115(18)30455-0

DOI: 10.1016/j.jnucmat.2018.09.024

Reference: NUMA 51205

To appear in: *Journal of Nuclear Materials*

Received Date: 27 April 2018

Revised Date: 4 September 2018

Accepted Date: 12 September 2018

Please cite this article as: D. Chartier, J. Sanchez-Canet, L. Bessette, S. Esnouf, J.-P. Renault, Influence of formulation parameters of cement based materials towards gas production under gamma irradiation, *Journal of Nuclear Materials* (2018), doi: https://doi.org/10.1016/j.jnucmat.2018.09.024.

This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting proof before it is published in its final form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.

ACCEPTED MANUSCRIPT

Influence of formulation parameters of cement based materials towards gas production under gamma irradiation

D. Chartier[1*], J.Sanchez-Canet[1], L. Bessette[2], S. Esnouf[3], J-P. Renault[4]

[1] CEA, DEN, Univ Montpellier, DE2D, SEAD, F-30207 Bagnols-sur-Cèze, France.

[2] Vicat, 4, Rue Aristide Bergès, F-38080 L'Isle d'Abeau, France

[3] CEA, DEN, DPC, SECR, F-91191, Gif-sur-Yvette, France.

[4] CEA, DRF/NIMBE 331 CNRS, F-91191, Gif-sur-Yvette, France

[*] Main Author , E-mail: david.chartier@cea.fr

Keywords: radiolysis, gamma irradiation, hydrogen, cement, Portland, sulfo-aluminate, waste, conditioning

Abstract

The release of radiolysis gas is a concern that may restrict the use of cement materials to condition intermediate level radioactive waste. Indeed, water naturally present in cement materials produces hydrogen gas (which can be explosive/flammable under some conditions) when it is exposed to ionizing radiation.

The primary goal of the MATRICE (MAterials Resistant to Irradiation based on Cement) project is to identify and define formulations of cement materials in order to minimize the quantities of hydrogen gas released by radiolysis. The first approach is the minimization of water amount in standard Portland materials (calcium silicate-based cements) by addition of specific compounds (superplasticizers) to enable the preparation of wasteform. The second approach is to use "alternative" cement such as calcium sulfoaluminate cement. This cement was expected to release less hydrogen because the quantity of water needed for cement hydration is higher than Portland and moreover, their hydrates differ from those of hydrated calcium silicate mostly encountered in Portland based materials.

Based on gamma irradiations with a ^{60}Co source, the results obtained demonstrate that the first approach is efficient but yet limited because the production of hydrogen of Portland pastes is about proportional to the total amount of water present in the materials. Thus, a tremendous drop of hydrogen production cannot be reach because rheological constraint does not allow a huge reduction of water, even with efficient superplasticizers. The second approach using calcium sulfoaluminate cements as an alternative binder provides results that are quite similar to Portland cement concerning the production of hydrogen under gamma irradiation.

Download English Version:

https://daneshyari.com/en/article/10147639

Download Persian Version:

https://daneshyari.com/article/10147639

Daneshyari.com