Development of solidification techniques with minimised water content for secondary radioactive aqueous wastes in Fukushima
(6) Incorporation of simulated secondary aqueous wastes in CAC and CAP cements

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Abstract

Incorporation of simulated secondary aqueous wastes was studied in the calcium aluminate cement (CAC) and calcium aluminate phosphate (CAP) with minimized water content. The inclusion of simulated secondary wastes did not disturb the fundamental reaction of the systems, but the significant salt contents resulted in Friedel's salt in CAC and chlorapatite in CAP.

Keywords: Calcium Aluminate Cements, Phosphates, Concentrated Effluent, Carbonated Slurry, Iron co-precipitated slurry

1. Introduction

Phosphates modified CAC cements (CAP) have been studied as an alternative matrix for the encapsulation of intermediate level wastes (ILWs) [1]. The use of phosphates allows not only to avoid the phase conversion reaction of the conventional CAC but also to generate a compact cementitious material with a reduced water content, which can be beneficial to avoid hydrogen gas generation associated with the radiolysis of water by radioactive wastes [2]. The present study investigates the incorporation of simulated secondary aqueous wastes (concentrated effluent, carbonated slurry and iron co-precipitated slurry) in these cements in terms of forming phases and microstructures.

2. Experimental

CAP pastes were prepared using the different secondary aqueous wastes as liquid of hydration. The water/cement ratio was 0.35 for all systems. CAC pastes were also prepared in the same manner as a reference. Samples were cured at either 35ºC or 90 ºC in open systems for 7 days. During this period the weight change of sample was monitored. After 7 days samples were characterized using XRD, TG, MIP and BSEM.

3. Results and Conclusions

Water content was found to be reduced to a larger extent in CAP cements cured at 90ºC than in CAC cured at 90ºC. Inclusion of simulated wastes did not significantly alter the formation of CAP or hydration of CAC. However, because of the high Cl content in the wastes, formation of chlorapatite was detected in all CAP systems cured at 90C. CAC containing simulated wastes, on the other hand, showed formation of the Friedel's salt.

References

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