Development of solidification techniques with minimised water content for secondary radioactive aqueous wastes in Fukushima
(7) Leaching test of CAC and CAP containing simulated secondary wastes

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Leaching tests have been conducted on CAC and CAP systems prepared with minimised water content, containing simulated secondary aqueous wastes to investigate their feasibility as wasteforms. In CAC, the effect of reduction in water content on leaching was small whereas CAP system indicated a significant benefit of reduction in water content. CAP appears to be beneficial to retain alkaline earth elements such as Sr, when cured at elevated temperatures.

Keywords: Leaching, Phosphate Cement, Calcium Aluminate Cement, Concentrated Effluent, Carbonated Slurry, Iron Co-precipitated Slurry, Strontium.

1. Introduction

Phosphate cements have been studied as an alternative matrix for the encapsulation of ILWs [1]. Because they solidifies through acid-base reaction, differing from the hydration of conventional cement, water content of the system can be reduced once raw materials are mixed. This is highly beneficial to minimise the risk of hydrogen gas generation due to the radiolysis of water by the radioactive waste components. In the present study, leaching tests have been conducted on CAC and CAP systems prepared with minimised water content, containing simulated secondary aqueous wastes (concentrated effluent, carbonated slurry and iron co-precipitation slurry) to investigate their feasibility as wasteforms.

2. Experimental

CAC and CAP pastes containing the simulated wastes were prepared curing at 35 and 90ºC for 1 week. Leaching test was conducted in accordance with ASI/ANS procedure for up to 90 days [2]. Leachates were analysed using ICP-OES, together with pH values. The tested materials were characterised using XRD, TG, MIP and BSEM/EDX after 90 days.

3. Results and discussion

The CAC system indicated a similar results both when cured at 35 and 90ºC, suggesting the effect of reduction in water content on leaching is small. The pH of leachate was ~12.0 in all cases, and significant amount of Ca and Al leaching was observed. XRD data suggested this is likely due to the dissolution of CA, the main clinker phase in CAC remained unreacted in the system. Formation of AFm phases (stratlingite and monocarboaluminate) was also observed. The effects of the curing condition and reduction of water content was more significant in CAP system. Leaching of Sr and Ca were reduced, along with that of P, suggesting that they are forming solid phosphate products. pH of the leachates was increased from ~11.3 to 11.7 reflecting this. CAP appears to be beneficial to retain alkaline earth elements such as Sr, especially when cured at elevated temperatures. The porosity was increased in all systems after 90 days of leaching.

References

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