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VITRIFICATION OF WASTE ARISING FROM DISMANTLING OPERATIONS USING DEM&MELT TECHNOLOGY

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Introduction

Dismantling operations of end-of-life nuclear facilities produces, or will produce, various new waste, mostly of lower activity than fission products, among which significant volumes of ILW-LL – long lived intermediate level activity waste, which will need to be managed. The nature of the waste is very wide-ranged, compared to the waste usually vitrified, in terms of chemical composition and physical form (solid deposits, sludge or liquid solution), depending on their origin and according to the mode of recovery or storage of this waste during dismantling and decommissioning operations.

Inactive sludges vitrification: a laboratory to pilot scale approach (DEM&MELT)

Among them, sludges/slurries represent a significant part of the produced waste. Their chemical composition and their humidity level, which can be variable, make their conditioning a challenge. One way to manage this waste is the vitrification process. This process has the advantage of stabilizing the waste in an inert mineral matrix, and of reducing the volume of waste to be stored, thanks to the high waste incorporation capacity of glass. In order to significantly increase the waste loading, a crystallized matrix or a composite matrix can be considered.

The In-Can vitrification tool DEM&MELT, developed by the consortium CEA (The Alternative Energies and Atomic Energy Commission), Orano and ECM Technologies is flexible enough to accommodate a varied waste stream and particularly adapted to sludges/slurries from dismantling operations. For this purpose, it is important to develop a vitrification adjuvant with optimized composition, in a suitable form in accordance with feeding system options.

Examples on inactive surrogates slurries from Fukushima Effluent Treatment* and on a sulphate-rich-sludge will be described in this study. If the first example has been investigated from the Laboratory to Pilot scale; for the second one, the temperature should be lower than usual ones used for glass elaboration, due to the composition of the waste, involving the use of low-viscosity frits. In this case, only lab scale route has been explored up to date.

Conclusion

Thanks to a panel of characterization methods such as differential thermal analysis (DTA), thermogravimetric analysis (TGA), X-ray diffraction (XRD), scanning electron microscopy (SEM), chemical analysis and viscosity measurements, precursors and wasteforms have been analysed, in terms of microstructure, durability, waste-frit reactivity and some adjuvants have been selected as promising precursors. Thanks to these results, the formulation of the different adjuvants will be optimized and tested on different sludges. The pilot scale extrapolation and the sustainability of the wasteform over time will then be explored.

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**Fukushima Effluent Treatment Waste* refers to the secondary wastes generated from the decontamination systems for contaminated water in Fukushima Daiichi Nuclear Power Station.