In-Can Vitrification of Spent Mineral Sorbents Using DEM&MELT Technology

Caroline MICHEL[1], Yann Papin[1], Maxime FOURNIER[1], Jean-François HOLLEBECQUE[1], Aliénor VERNAY[1], Régis DIDIERLAURENT[2]

[1] *French Alternative Energies and Atomic Energy Commission (CEA),* DES, ISEC, DPME, Univ. Montpellier, Marcoule, France
[2]*ORANO*, Châtillon, France

THE UPSCALING METHODOLOGY APPLIED ON COMMON MINERAL SORBENT COMING FROM DECONTAMINATION EFFLUENT TREATMENT

WASTE TO VITRIFY : Natural Chabazite Zeolite

- Zeolite are commonly used to decontaminate Cs and Sr from liquid effluent
- Experiments with Cs-impregnated zeolite, up to 10 mg of Cs per g of adsorbent
- Borosilicate glass frit was used (Na_2O, B_2O_3, SiO_2)

Natural chabazite-type Zeolite 0.7-2 mm

Oxides Zeolite (w.%)	
Al_2O_3	17
CaO	5,5
Fe_2O_3	3
K_2O	4.5
MgO	1.25
SiO_2	51.5
Others	17.25
TOTAL	100

Decontamination performance

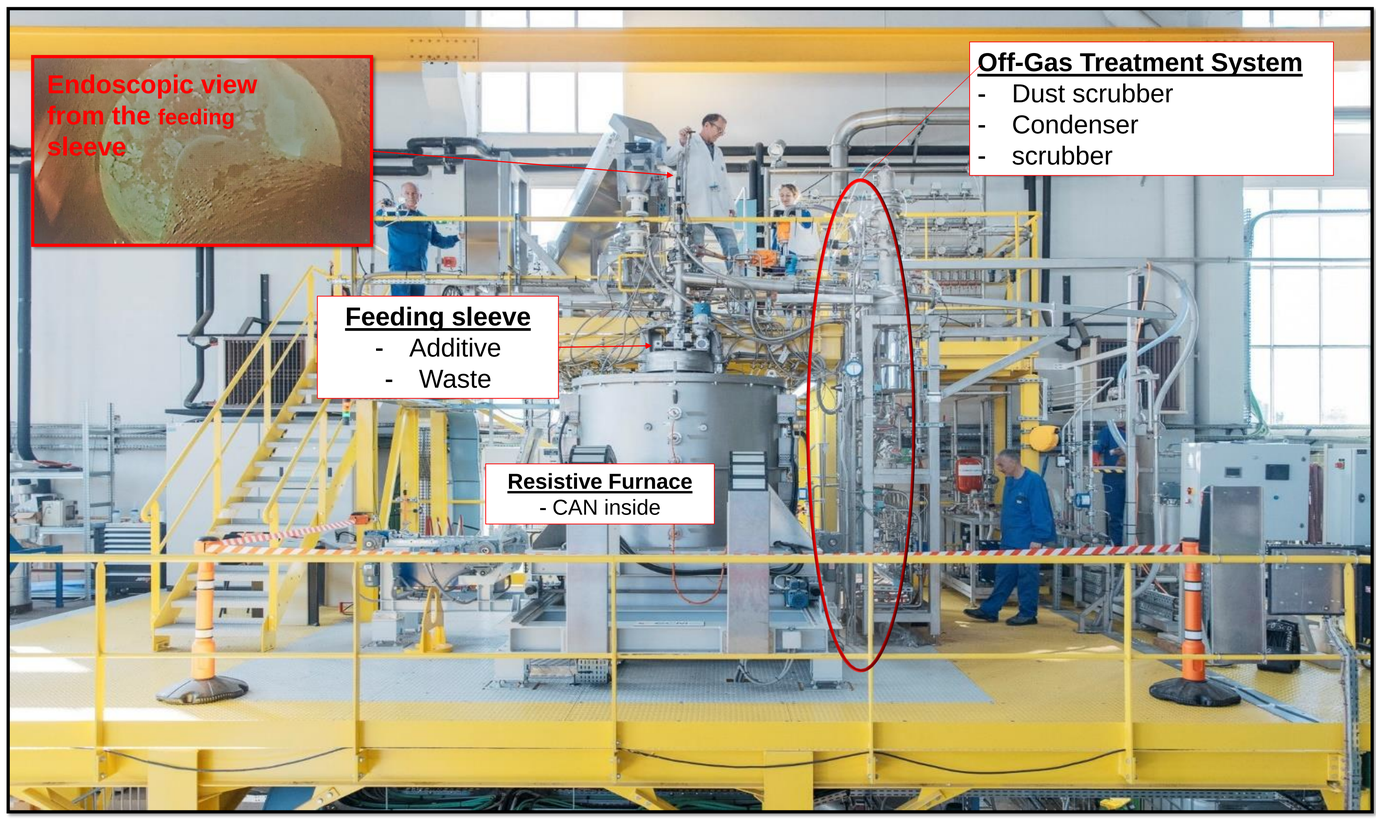
- Volatility is calculated as:

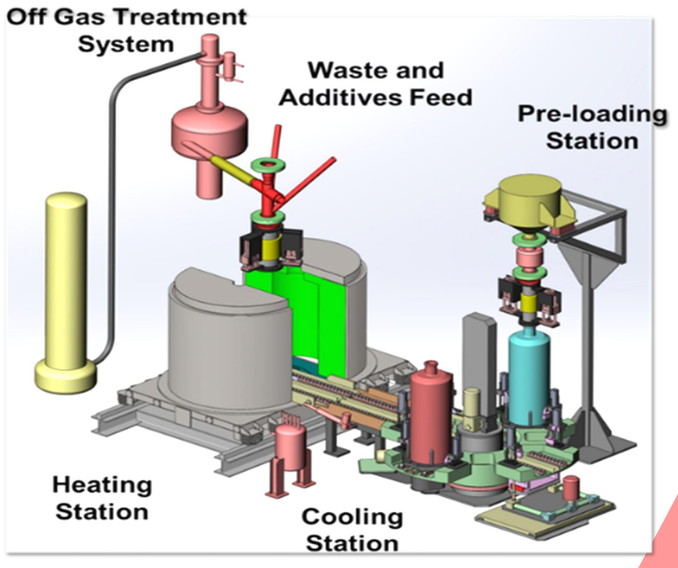
$$v = \frac{mass\ of\ element\ recovered\ in\ condenser + scrubber}{mass\ of\ element\ fed\ (frit + waste)}$$

Element	Volatility (w.%)
Cs	0,085
Sr	0,0058
K	0,045
Na	0,0076

Zeolit dosing unit
- Up to 30 kg / h
- Double sealed valves

FULL SCALE #300 kg





Main results

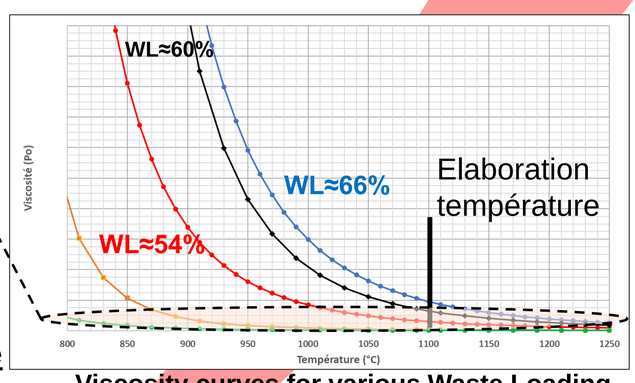
- A full CAN of homogeneous glass was obtained
- Final WL was 59,1 % of zeolite (60% targeted)
- Several zeolite feeding rate were tested [6-20] kg/h

LABORATORY SCALE #100 g

DEM&MELT PROTOTYPE Commisionned in 2020

$$WL(\%) = \frac{mass\ of\ waste\ (kg)}{mass\ of\ wasteform\ (kg)} \times 100$$

To deal with viscosity domain and WL:
Chosen WL for Full-Scale experiment is 60%

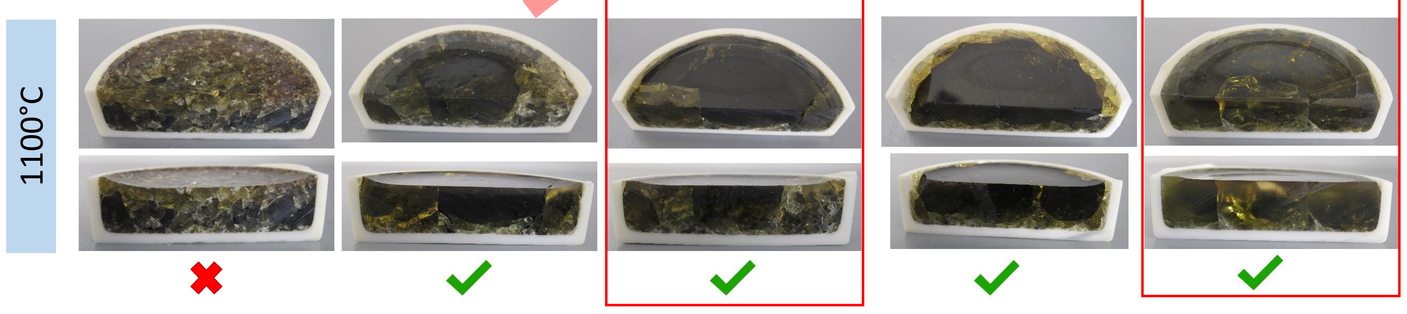


Viscosity curves for various Waste Loading

Feasibility validated at laboratory scale

- Ranges for waste loading
- Operating temperature
- Mixture strategy
- Melted material
- Viscosity < 200 Po
- Microstructure

Viscosity measurment



Half-cut CAN
263 kg of final glass
WL = 59,1% of zeolite