



HAL
open science

Numerical simulations in the development of the French radioactive waste vitrification processes using induction furnace.

Patrice Brun, Emilien Sauvage

► To cite this version:

Patrice Brun, Emilien Sauvage. Numerical simulations in the development of the French radioactive waste vitrification processes using induction furnace.. ACSAC 2019 - 35th Annual Computer Security Applications Conference, Jul 2019, Paris, France. cea-04742474

HAL Id: cea-04742474

<https://cea.hal.science/cea-04742474v1>

Submitted on 17 Oct 2024

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

Numerical simulations in the development of the French radioactive waste vitrification processes using induction furnace.

P. Brun, E. Sauvage

CEA, DEN, DE2D, SEVT, LDPV F-30207 Bagnols-sur-Cèze, France

For many years, the CEA-Marcoule has developed various processes dedicated to radioactive waste confinement, especially vitrification. For 10 years now, induction heating, fluid mechanics and thermal simulations take part of all new R&D projects. The contribution to such simulations is, first, the enhancement of the working knowledge of existing processes. Those data are very useful to define optimisation choices. Second, the simulations are used at the conception stage of new processes as a tool allowing wide ranges parametric tests. This has been extensively used in the design of the cold crucible inductive melter (CCIM) commissioned in 2010 at AREVA La Hague plant. Whatever the purpose, potential benefits of reliability, output capacity and life time can be obtained. The simulation skills of the laboratory have been promoted since the early stage of the vitrification processes development. In the 80s, numerical simulations dedicated to electromagnetic studies helped design the high frequency generator for induction heating and then thermal simulations were conducted to ensure the temperature of glass melts and check furnace performance. The first flow simulations of molten glass were conducted in the 90s to verify thermal homogeneity on simplified configurations, essentially bidimensional. The outstanding increase of computation capacity which occurred these last 15 years coupled to the increased capabilities of the modelisation softwares, allows us to be much more ambitious. Nowadays we use tools able to simulate induction heating from low to high frequency coupled to thermal simulation with the Joule power density in the metallic part of the process as well as in the molten glass itself. On the other hand, two conditions are absolutely necessary to ensure the relevance of such complex numerical simulations : reliable data on physical properties and experimental confrontations. Special efforts have to be done to fulfill those two conditions. The characterisation of nuclear glass is performed thanks to specific instrumentations and experimental confrontation is done with the combination of (i) full scale tests on inactive pilots and (ii) small scale tests on analytical equipement.