Melting of incinerator ashes using a microwave furnace

Fact Sheet

Project Information

Grant agreement ID: FI2W0100

Project closed

Start date
1 July 1991

End date
30 June 1995

Funded under
Specific research and technical development programme (Euratom) in the field of management and storage of radioactive waste, 1990-1994

Total cost
€ 720 000,00

EU contribution
€ 360 000,00

Coordinated by
Commissariat à l'Energie Atomique (CEA)
France

Objective

The purpose of this investigation is to design, build and test an inactive prototype microwave melting facility for incineration ashes, with a capacity not exceeding a few kilograms per hour. The microwave melting technique will significantly reduce the ash disposal volume while ensuring chemical and mechanical stability comparable to that of the most favourable radioactive waste containment matrices. This technique is also particularly well suited for the treatment and conditioning of radioactive ashes, which are produced in relatively small quantities (about 10 m{3} per year) based on projections for the French MELOX mixed UO2-PuO2 oxide fuel fabrication plant.

Existing processes for the melting of incineration ashes were inventoried, and data on the dielectric properties of materials were compiled.

The glass composition has been specified and tested, but leach tests have not been terminated.

The selected design calls for a cooled metal casting furnace heated by a single mode generator operating at 915 MHz. Other devices continue to be investigated. The dielectric constants of glass component elements were compiled, revealing that no glass components are receptive to microwaves at room temperature, but that one of the principal components (aluminum oxide) is highly receptive at temperatures above 400 C. An additive capable of increasing the microwave susceptibility of the mixture is therefore required; magnetite (Fe304) was finally selected for its strong microwave absorption capacity at low temperatures.

Single mode operation was chosen to obtain a high specific power rating and ensure more uniform heating without the hot spots observed in multimode systems. Microwaves directed parallel to the surface were adopted rather than perpendicular or oblique waves to increase the melting surface area and minimize hot spots. A continuous casting melter using a cooled metal structure was chosen to limit corrosion. The facility uses a 25 kW 915 MHz generator to allow a throughput of several tens of kilogramme per hour.
Work programme:

- bibliographic review and interrogation of data bases on microwave melting (existing processes, operating conditions, dielectric properties of materials)

- laboratory study on specification and development of a glass composition for ash incorporation compatible with certain constraints: moderate melting temperature (1100 C), satisfactory microwave susceptibility and suitable glass leaching resistance

- Selection of a melting device: generator power and frequency; melter type: casting furnace or expendable crucible furnace; energy transmission mode: single-mode or multimode; crucible structure: cooled metal or refractory material; glass casting mode: batch or continuous and microwave cavity design

- Design and construction of the melting facility

- Testing and development

- Technical and economic assessment

Fields of science (EuroSciVoc)

engineering and technology > other engineering and technologies > nuclear engineering > **nuclear waste management**

engineering and technology > **materials engineering**

engineering and technology > environmental engineering > **energy and fuels**

engineering and technology > environmental engineering > waste management > **waste treatment processes**

Programme(s)

FP2-RADWASTOM 4C - Specific research and technical development programme (Euratom) in the field of management and storage of radioactive waste, 1990-1994

Topic(s)

A.2.2 - Reduction of waste volumes to be disposed of

Call for proposal

Data not available

Funding Scheme

CSC - Cost-sharing contracts

Coordinator

Commissariat à l'Energie Atomique (CEA)

EU contribution

No data

Total cost

No data

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