Development of the Large-scale Cold Crucible Induction Melter for Vitrification

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KHNP has developed the vitrification technology of radioactive waste and operated the commercial vitrification facility since 2009 in Hanul Nuclear Power Plant. Based on the R&D and commercial experience, the KHNP has successfully developed and tested the large-scale CCIM with the inner-diameter of 85cm. And the pilot tests have been conducted for treating a wide range of wastes such as Slurry, Resin, DAW, Filters, etc.

Keywords: Vitrification, Cold Crucible Induction Melter (CCIM), Radioactive Waste Treatment

1. Introduction

KHNP has developed the vitrification technologies for treating the Low-and-intermediate radioactive waste since 1994, constructed the pilot plant in 1999, and conducted the pilot tests over 100 times. Based on the design data produced with pilot tests, the commercial plant(HanUl Vitrification Facility, UVF) was constructed in HanUl Nuclear Power Plant in 2009 and has been operated successfully up to now. KHNP plans to construct the next vitrification facility with the UVF commercial operation experience, therefore KHNP has developed the large-scale cold crucible induction meter (CCIM 85) from 2009, and conducted the pilot tests with many kinds of wastes.

2. CCIM Development and Pilot test

2-1. Design and Manufacture of CCIM

The vitrification technology of CCIM is to incorporate the radioactive nuclides into a stable glass matrix using CCIM. The high frequency electric power is used to melt the glass and vitrify the radioactive wastes. To develop the large-scale CCIM with the inner diameter of 85cm, the shapes of sector are designed for the high efficiency and the electric magnetic field simulation is conducted using the computer simulation code. The three sector shapes were decided and manufactured via these computer simulations.

2-2. Performance and Pilot tests of CCIM

After the manufacture of CCIM 85, the metal load test, glass melting test, and waste treatment test were conducted successfully. The optimum glass weight to be melted is evaluated about 180kg. The necessary electric power to melt glass of one kg is about 0.47kWh and the electric power efficiency is enhanced about 33% compared to the small CCIM. The maximum waste throughput can be evaluated by 60kg/hr (Figure 1).

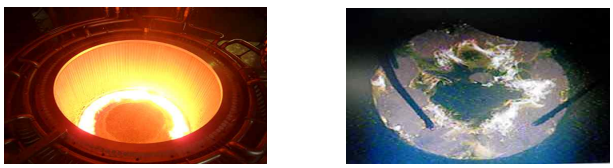

Figure 1. Glass Melting(left) and Waste Vitrifying Test(right)

3. Conclusion

Based on the experience of R&D and UVF project, KHNP has commenced the development of the large-scale CCIM from 2009. The large-scale CCIM has been successfully developed and its performance has been verified with the pilot tests.