9-3 Toward Analysis of Radionuclides in Solidified Products
—Preparation of Reference Materials Containing Volatile Nuclides—

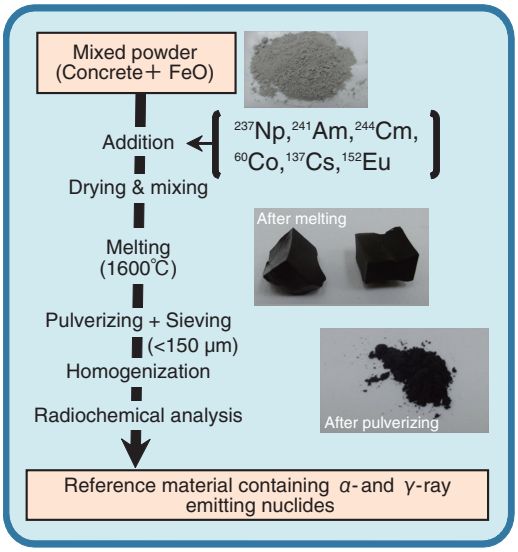

Fig.9-6 Preparation method for reference material of solidified product containing α- and γ-ray emitting nuclides
Reference material of solidified product contaioning α- and γ-ray emitting nuclides such as ^{241}Am and ^{60}Co was successfully prepared. Additionally, ^{137}Cs was quantitatively retained in the reference material by maintaining low basicity (CaO/SiO_2).

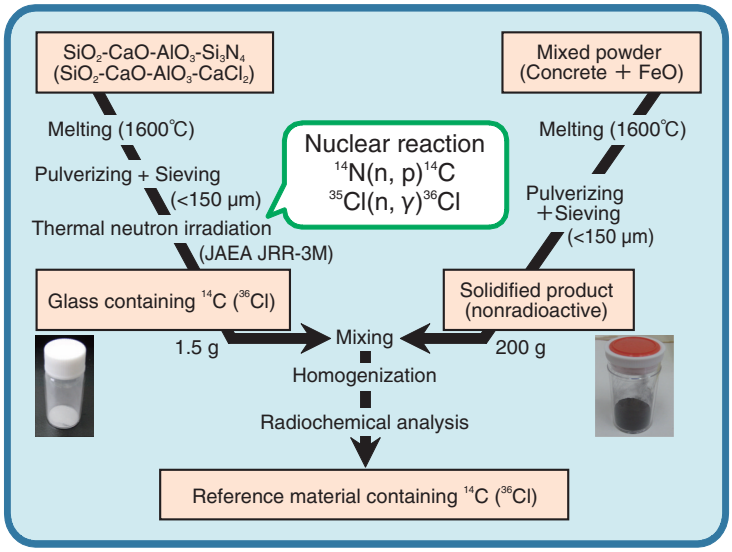

Fig.9-7 Preparation method for reference material of solidified product containing ^{14}C or ^{36}Cl
Reference materials containing volatile nuclides (^{14}C or ^{36}Cl) have been successfully prepared through the nuclear reaction of ^{14}C or ^{36}Cl in a glass.

At the Advanced Volume Reduction Facilities (AVRF) of the JAEA, it has been decided that nonmetallic low-level radioactive solid wastes will be melted in a plasma heating furnace and converted to stable solidified products. For performing disposal of radioactive waste packages containing the solidified products, the evaluation of radioactivity inventories for selected nuclides is necessary. We therefore need to analyze radioactive samples similar to the solidified products to collect radioactivity data.

In order to verify the reliability of the radiochemical analysis, it is necessary to check whether an appropriate procedure has been followed. If we can use a reference material (RM) containing a known amount of the nuclides of interest, the reliability can be evaluated. In this study, preparation methods for simulated solidified products were investigated in order to prepare RMs for the radiochemical analysis of some α-, β- and γ-ray emitting nuclides.

At the AVRF, it has been decided that major non-metallic low-level radioactive solid wastes, namely concrete together with steel drams, will be processed by plasma melting. To simulate a major chemical composition of the solidified products, non-radioactive concretes and a chemical reagent (FeO) were used. In addition, we employed a laboratory-scale electric furnace to simplify the preparation method.

It is very difficult to ensure that volatile nuclides such as ^{14}C, ^{36}Cl, and ^{137}Cs remain stable at high temperatures in a solidified product. It is well known that volatile metals such as Cs in the solidified products can be stabilized by maintaining low basicity. Under optimized conditions, it was found that solidified products containing ^{137}Cs could be successfully prepared (Fig.9-6). For ^{14}C and ^{36}Cl, which are more easily volatile elements than Cs at a high temperature, it will be difficult to adjust the interest nuclide concentration in the solidified product on the preparation method of Fig.9-6. Therefore, we examined the following preparation method involving a nuclear reaction to produce a known amount of ^{14}C or ^{36}Cl in a glass. A RM containing either ^{14}C or ^{36}Cl was successfully prepared by the glass (1.5 g) and a solidified product (200 g) prepared from a mixture of nonradioactive concretes and FeO (Fig.9-7). We are planning to use the present preparation methods for the collection and evaluation of data on the radioactivity of wastes at the JAEA.

Reference

Ishimori, K. et al., Preparation of Reference Materials on Radiochemical Analysis for Low-Level Radioactive Waste Generated from Japan Atomic Energy Agency, Proceedings of the ASME 13th International Conference on Environmental Remediation and Radioactive Waste Management (ICEM2010), Tsukuba, Japan, 2010, ICEM2010-40111, 7p., in CD-ROM.