Investigation of Trapping Characteristics of Iodine From CsI

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1. Introduction

An accumulation of spent fuel has brought a considerable interest due to its energy and environmental issue. Pyroprocessing has been investigated in Korea Atomic Energy Research Institute (KAERI) which reduces the accumulated spent fuel and increases the efficiency of fuel cycle. In head-end process of pyroprocessing, UO_2 pellets are produced from a fuel bundle and various radioactive gases from a spent fuel are released during thermal treatment. Within these gases, I-129 is a harmful semi-volatile gas which had very long half-life with radioactivity, and therefore iodine should be captured using trapping system.

It is well known that iodine highly reacts with silver to form AgI, and these structures are very stable. KAERI had developed iodine trapping process using silver-functionalized zeolite (AgX) as an adsorbent. In this study, iodine trapping process was designed and adsorption behaviors were investigated by using AgX filters.

2. Experimental Section

The CsI as an iodine source and silver-functionalized zeolite (AgX) were prepared from Sigma-Aldrich. The iodine trapping system was consisted of three high temperature regions; CsI vaporization, cesium adsorption, and iodine adsorption zones. CsI was placed in the alumina boat in the center of the vaporization zone and temperature fixed to 1100℃. In the cesium adsorption zone, a Inconel-based cartridge was filled with cylindrical silica-alumina (SA) filters. The temperature of adsorption zone is set at 1000℃ for cesium to react SA filters. The AgX was loaded in the cartridge as shown in Fig. 1, which was placed in cylindrical alumina tube and adsorption temperature was set at 200℃ for iodine capture. For the untrapped cesium and iodine particles, ultra-low particulate air (ULPA) membrane filters and wet-scrubbers were installed at the end of the system.

3. Iodine Trapping Characteristic

Iodine trapping efficiency was measured by comparing mass of iodine vaporized and that of adsorbed on AgX. In addition, wet-scrubber was used to measure iodine concentration of emitted gas from trapping system.

4. Conclusion

Trapping process was designed for iodine capture using trapping system with AgX filters. Iodine trapping performance was investigated and it was confirmed that most of iodine vaporized were effectively captured in the trapping system using AgX filters.

Fig. 1. AgX and AgX filter cartridge.