

## Trickle bed Reactor for the Hydrogen Isotope Exchange Reaction

Seungwoo Paek, Do-Hee Ahn, Kwang-Rag Kim, Minsoo Lee, Sung-Paal Yim, Hongsuk Chung

Korea Atomic Energy Research Institute, 150 Duck-Jin Dong, Yusung-Ku, Daejeon

[swpaek@kaeri.re.kr](mailto:swpaek@kaeri.re.kr)

The CECE (Combined Electrolysis Catalytic Exchange) with a hydrophobic catalyst is a very effective method to remove small quantities of tritium from light or heavy waste water streams because of its high separation factor and mild operating conditions. This paper deals with the experiment for the hydrogen isotope exchange in a trickle-bed reactor packed with a hydrophobic catalyst and the design of the catalytic column for the CECE to tritium recovery from light water. A hydrophobic Pt/SDBC catalyst which has been developed for the LPCE column of WTRF (Wolsong Tritium Removal Facility) was tested in a trickle bed reactor. The catalyst column was packed with a mixture of a hydrophobic catalyst and hydrophilic packing (Dixon gauze ring). An experimental apparatus was built for the test of the catalyst at various temperatures and gas velocities. The difference in the deuterium concentration between the inlet and outlet gas samples was analyzed by using a Gas Chromatography. Catalyst performance is expressed as an overall rate constant  $K_{ya}$  ( $\text{m}^3(\text{STP})\text{s}^{-1}\text{m}^{-3}$ ). The overall rate constant of the Pt/SDBC catalyst was deactivated with the operating time because of a slow condensation of the water in the pores of the catalyst.  $K_{ya}$  increases with the hydrogen flow rates in the range 0.4 to 1.6 m/s at STP. The overall rate constant may be high enough for less demanding applications such as the CECE process.