Endurance Test Facilities for Hydrophobic Isotope Exchange Catalyst

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One of the most used methods for tritium recovery from tritiated water relies on Combined Electrolysis Catalytic Exchange and Cryogenic Distillation processes. The presence of tritium in system induces an intense radiation field especially at the interface between hydrophobic support and HTO. Significant structural changes with potentially negative effects can be induced. The study presents the facilities and experimental protocols for testing of isotope exchange catalyst in presence of high activity tritiated water.

The catalytic filling is introduced in 316 L stainless steel columns with 50 cm height and 1 cm inner diameter. The ends of columns are provided with 2 tanks of 10 ml. The tanks are connected through a tube for to equalize the pressure. Tritiated water flows gravitationally over the catalytic filling. The continuity of the process is assured by the rotation with 180° at established times in function of the filling characteristics. The rotation is automated by an electrical engine. The entire ensemble is introduced into a thermostatic space provided with a gas recycling system over a desiccation cartridge and with a tritium gas monitor 400 SBDγC/Overhoff.

After the exposure, each column is removed from the thermostatic space, the tritiated water is sampled and the catalytic filling is decontaminated. The characteristics of catalytic filling are determined and compared with a sample column. The chemical composition of tritiated water is determined by a Ion Chromatography (ICS 3000/Dionex) and pH/Ion-metry.

The exposed catalyst is analyzed in respect of radioinduced changes using a FT IR ATR Tensor 27/ Bruker spectrometed. The distribution of porosity can also be analyzed.