

8th World Congress on Chromatography

4th International Conference on

&

Polymer Science and Technology

September 13-14, 2018 | Prague, Czech Republic

Application of Cryogenic Preparative Chromatography in Hydrogen Isotopes Separation



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The separation of large-scale hydrogen isotopes is important in the process of nuclear fusion energy development and utilization. So far, there are few hydrogen isotope separation techniques suitable for industrial scale applications, and cryogenic preparative chromatography has advantages in terms of simple equipment, reliable operation, large separation factor, high product purity, and low retention of tritium. In this paper, a cryogenic chromatography method for reprocessing Tokamak exhaust gas is described. The experimental apparatus consists of a column with carbon molecular sieve used as exhaust storing and purification unit, four columns with 5A molecular sieve operated at the temperature of liquid nitrogen to adsorb hydrogen isotopes. In order to raise the efficiency and to shorten the total time of isotope separation and the total length of columns between two columns, a disproportionate equilibrators for isotope exchange of HD and HT was inserted. After passing through the cascade columns, the protium, deuterium and tritium are separated cleanly. The overall recoveries of deuterium and tritium for cleanup isotope separation procedure are greater than 97%, and the protium removing efficiency is larger than 98%. Further refining the process operating parameters, be able to get an ideal result, and is expected to meet the requirements of self-sustaining tritium fuel cycle.

Biography

Chengjian Xiao has his expertise in deuterium-tritium fuel cycle of nuclear fusion energy. The group is dedicated to the extraction, separation and purification technology of hydrogen isotopes in order to meet the requirements of the tritium extraction process, the Tokamak DT gas recycling and the tritium wastewater treatment.

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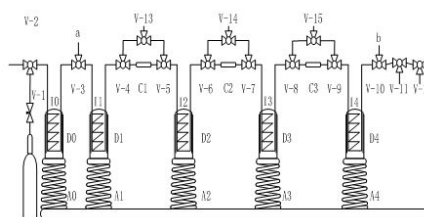


Fig.1 Preliminary device of cryogenic preparative chromatography for hydrogen Isotopes separation

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