

NUCLEAR ENERGY UNIVERSITY PROGRAMS

Tritium Sequestration in Gen IV NGNP Gas Stream via Proton-Conducting Ceramic Pumps

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Initiative/Campaign: Gen IV/Heat Transport

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Abstract

This project is aimed at addressing issues related to tritium sequestration for effective utilization of heat in the Next-Generation Nuclear Plant (NGNP). Trace levels of tritium are present in the exhaust gas streams, posing a technical hurdle to using heat from the high-temperature exhaust, with an outlet temperature expected to be 850°C - 900°C. This presents a significant challenge, since the removal of tritium from the high-temperature gas stream, usually accomplished at low temperatures through a tritium-permeable membrane or hydrogen isotope getters, must be accomplished at elevated temperatures in order to make use of this heat in downstream processing. The objective of this project is to experimentally evaluate alternative tritium separation technology based on ceramic separation membrane materials with high-temperature proton conductivity. The focus will be demonstrating the feasibility of tritium sequestration via high-temperature proton pumps, fabrication and performance evaluation of thin-film high-temperature nanocrystalline proton conductors for tritium separation, and development of mixed protonic and electronic conducting thin films for high-temperature tritium permeation systems.