Materials & Chemicals

Generating Medical Isotopes with Safer Vessel and Materials

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Overview

Medical isotopes are valuable healthcare tools for patient imaging and disease treatment. Yet most radioisotopes used in medicine are produced in nuclear reactors, which are complex, generate high volumes of radioactive waste and typically employ highly enriched uranium (HEU), which carries security risks. The molybdenum-99 isotope, for example, is produced in foreign reactors often requiring the export of HEU from the United States – raising fears of interception and nuclear proliferation.

It has been proposed to generate medical isotopes using low enriched uranium (LEU), which cannot be used directly to manufacture nuclear weapons. In these systems, ions are injected into a gas chamber to generate neutrons. These particles in turn strike neutron-rich parent material (like LEU) held in a nearby aqueous solution vessel, creating a chain reaction of isotope-producing collisions.

However, maintaining stable power levels in aqueous reactors or fissile targets can be difficult as the temperature of the solution rises and gas bubbles are created. A typical reactor control system trying to hold constant power may not be able to react fast enough, leading to unstable power levels and potential safety hazards.

The Invention

Wisconsin researchers have developed a ring-shaped, or annular, fissile solution vessel for generating medical isotopes.

The assembly holds three nested chambers. Ions are first directed into an internal target chamber containing a gas. The neutrons that are generated pass outward, through a cooling jacket, into the surrounding fissile solution vessel. This vessel contains an aqueous composition of nuclear material and is shaped to increase heat transfer area to volume. Neutrons strike the nuclear material, generating isotopes and additional neutrons. The solution vessel is separated by another cooling jacket from an outer chamber that reflects neutrons.

Applications

- Production of medical isotopes
- Food irradiation and quality assurance inspections

Key Benefits

- Better reaction stability
- Enhanced cooling
- LEU avoids security risks
- Works with low concentrations of nuclear materials
- System can use variety of different fissile solutions.

- More control over reaction rate

Tech Fields

- Materials & Chemicals : Synthesis
- Medical Imaging : Other diagnostic imaging

For current licensing status, please contact Jeanine Burmania at jeanine@warf.org or 608-960-9846