ICANS XX,
20th meeting on Collaboration of Advanced Neutron Sources
March 4 – 9, 2012
Bariloche, Argentina

Mo-99 Production Using Photoneutron and Spallation Neutron Sources

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Abstract

Developing United States production of the medical isotope Mo-99 is a key goal of the Department of Energy's Global Threat Reduction Initiative, in partnership with both prospective commercial suppliers and National Labs. Two frontrunner technologies that are being funded in support of this goal rely on the generation of Mo-99 from the fission of Low Enriched Uranium (LEU) in dilute acid solutions. These technologies, based on the LEU solution reactor concept and a subcritical LEU solution target driven with a DT neutron generator, both involve fission in acidic uranium solutions and the subsequent separation of Mo-99 from such solutions. For such processes to reach commercial maturity a much greater understanding of solution reactor chemistry, both for maximizing Mo-99 yields during safe operation and for minimizing Mo-99 losses during subsequent separation processes, is required. Samples for chemistry research are being produced using photoneutron and spallation neutron sources at Los Alamos National Laboratory. Valuable chemistry results have been obtained from initial small scale irradiations. The MCNPX and CINDER codes were used to design target-moderator-reflector systems for sample irradiations and calculated neutron fluxes, Mo-99 yields and dose rates compare well with measurements. Plans are being made to increase the scale of spallation target experiments to production facility levels so that separations chemistry and engineered systems can be fully demonstrated in support commercial production facility licensing.