Preparation of highly radioactive targets for nuclear data measurements

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Nuclear data for neutron induced reactions on short-lived radioisotopes are critical for a wide range of applications spanning from radiochemical diagnostics, nuclear reactor designs to nuclear astrophysics. In this contribution, fabrication of two different targets: (1) ^{56}Ni electroplated on gold foil and (2) ^{88}Zr-filled tungsten canister within a hot cell will be described. Tools developed to accomplish these unique experiments by remote handling techniques will be highlighted. Nickel-56 ($t_{1/2}$ = 6.075 days) was produced by medium energy proton-induced reaction on natural cobalt target at Isotope Production Facility (IPF) at Los Alamos Neutron Science Center (LANSCE). After target dissolution, approximately 100 mCi of ^{56}Ni was separated from bulk of cobalt by cation-exchange chromatography. The final step involved electroplating of isolated and purified ^{56}Ni on a 6 μm-thick gold foil mounted on a metal frame. This sample was studied using the fast neutron beams available at the Weapons Neutron Research (WNR) facility at LANSCE [1, 2]. The second project involved production of ^{88}Zr ($t_{1/2}$ = 83.4 days) via low-energy proton irradiation of natural yttrium target at IPF. The yttrium target was dissolved and several curries of ^{88}Zr were isolated utilizing hydroxamate-based extraction chromatography resin. Zirconium-88 was concentrated to very small volume in hydrochloric acid. An automated dispensing unit was designed and installed inside a hot cell to dispense samples of ^{88}Zr ranging from 4 to 8 microliters into tungsten canisters and enclosed using lead plugs. Neutron transmission measurements were performed on these ^{88}Zr-filled samples at LANSCE utilizing the Device for Indirect Capture Experiments on Radionuclides (DICER) [3, 4].

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