Composite foil target materials for use with high intensity beams at ISAC

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Target materials for radioactive ion beam production with intense proton beams must posses thermal properties capable of dissipating kilowatts of deposited beam power. When metal targets cannot produce the desired products, refractory compounds are the next best option. The powder targets used successfully with low beam intensities cannot efficiently dissipate the deposited power of ISAC beams; more robust forms with high thermal conductivity are required. Composite target foils consisting of refractory metal carbides layered onto flexible graphite sheet have been developed at ISAC for use with high intensity beams. The composite foils are much thinner than the pressed carbide pellets previously used. Prior to sintering, densities of the carbide layer are ≥ 50% of theoretical density. In combination with the graphite layer, the composite foil thermal conductivity can be twice as high as for the carbide alone. Heat transfer is further enhanced by close thermal contact between the foils and the target container. Composite carbide/graphite targets have operated with up to 70 μA p^+ intensities at ISAC producing both intense beams for astrophysical reaction studies (5×10^{10} ^{26g}Al/s) and short-lived species for nuclear spectroscopy studies (9.6×10^{3} ^{62}Ga/s). Both aqueous and non-aqueous techniques have been developed for fabrication of SiC, TiC and ZrC composite foils subsequently irradiated at ISAC. Development of a non-aqueous, inert-atmosphere technique for fabrication of a high thermal conductivity actinide target (UC_2/graphite) foil is underway. Initial fabrication development is conducted using LaC_2 as an analog for UC_2.