Design and Characterization of High Power Targets for RIB Generation

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Worldwide interest in the use of accelerated radioactive ion beams (RIBs) for exploring reactions important in understanding the structure of the nucleus and nuclear astrophysical phenomena has motivated the construction of facilities predicated on their production by the Isotope-Separator-On-Line (ISOL) technique. Experimentally useful RIBs are often difficult to generate by this technique because of the times required for diffusion from the interior of the target material, and to effusively transport the species of interest to the ion source following diffusion release in relation to the lifetime of the species of interest. For this production method, short diffusion-length, low-density, highly permeable targets with good thermal management properties are required that can withstand irradiation with high power production beams at RIB facilities such as the proposed RIA. In such high power targets, provisions must be made for removal, or reduction to tolerable levels, of production beam or fission and spallation product deposited heat. In this report, we present results from thermal modeling studies that suggest that production beam manipulation and radiation cooling techniques can be used in combination to control target temperatures to manageable levels when subjected to irradiation with 1 GeV, 100 kW proton beams.

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