

Thermal analysis of uranium carbide for use in two-step ISOL targets*

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The development of uranium carbide target materials for use in two-step, neutron-generator secondary targets at high power ISOL facilities is in progress. The challenge is to fabricate the target material in a form that has relatively high density, good thermal conductivity, and rapid release properties for a variety of isotopes. This contribution presents an assessment of the current status of the material fabrication and thermal characterization. As part of a validation process, thermal conductivity of three thicknesses of Grafoil, corresponding to 0.020", 0.030" and 0.039" thick disks were measured using the method of electron bombardment recently developed at Argonne National Laboratory (ANL) [1]. A thermal analysis was made for the heated disk using the code FlexPDE [2], solving the partial differential equations and extracting the thermal conductivity of this material as a check of this method. Comparison to the published Grafoil thermal properties from the Graftech Engineering and Design Manual [3] are shown. Similar Grafoil disks were measured at Oak Ridge National Laboratory by the method of laser flash thermal diffusivity with the thermal conductivity through the sample calculated using the measured heat capacity. Comparison to the experimental values measured at ANL and published data from Graftech are presented. These experimental techniques and analysis were then extended to measurements of uranium carbide disks which are of interest in two-step targets.

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[1] Proceedings of the 2003 ANS Embedded Topical Meeting, "Nuclear Applications of Accelerator Technology," (AccApp03), San Diego, CA, June 1-5, 2003;

[2] FlexPDE 4.2.7s (student version) www.pdesolutions.com;

[3] Grafoil Flexible Graphite, Engineering Design Manual Copyright 2002 2nd Edition.