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Uranium Carbide Target Development

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Content

Background: Radioactive ion beams at ISOLDE are produced by the interaction between an intense proton beam with a thick target material [1]. Micrometric UCx-based targets are the current reference at ISOLDE, but a significant increase on the yields of exotic isotopes is expected to be obtained from nanostructured and porous UCx targets.

Key Method: Electrospinning is a top-down technique of making fibers [2]. In this method, a high tension is applied between two electrodes, a needle connected to a syringe and an aluminium collector. A polymer solution is inserted in the syringe and ejected at the tip of the needle, being held by its surface tension and subjected to the high electric field to form a Taylor cone. After discharging, the polymer solution undergoes a bending instability and elongation process, which allows the jet to become thinner, leaving a solidified fiber on the collector.

Experimental Results: uranium precursor nanofibers were prepared by the electrospinning method. The solutions for electrospinning were prepared by dissolving a uranium salt (acetate, acetylacetonate, and formate) and cellulose acetate in glacial acetic acid and 2,4-pentanedione solvents in 2 : 1 ratio. The fibers were heated up to 550 °C in argon atmosphere with a heating rate of 1 °C / min to decompose the polymer. The obtained material was further heat-treated at 1750 °C for 2 h in vacuum to carboreduce the oxide. The final material is composed of small-sized grains, with an average below 10 nm.

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