Thorium carbides target: The importance of the raw materials' properties

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Abstract

In the framework of MYRRHA project, an Isotope Separator On-Line (ISOL) facility is going to be implemented at the 100 MeV accelerator of MYRRHA at SCK•CEN, and will be licensed to operate at beam intensities up to 500 µA on non-actinides targets and 200 µA on actinide targets. Thorium and uranium carbide targets material will be the backbone of the irradiation campaigns. The combined fission process and the smaller spallation region around the thorium and uranium will allow to produce a vast array of radioisotopes from nearly the whole nuclear landscape. A high release efficiency of isotopes from the target is based on a good thermal diffusion and stability at high temperatures, which is closely connected to the chemical composition and the structural and textural properties of the material i.e. crystalline phase, grain size and porosity. The synthesis of the thorium target material is based on the complete conversion of the thin pellet in its oxide form to its carbide by carbothermal reduction reaction. For this reaction to become allowed thermodynamically, high temperatures (above 2000 °C) and high vacuum pressure are required. Apart from these extreme conditions, the properties of the raw materials i.e. thorium oxide, ThO_2, and carbonaceous material powder e.g. graphite, carbon black, graphene, nanotubes, etc. are greatly relevant to the reaction and the final properties of the thorium carbide material. The thorium oxide that will be used as raw material, is going to be produced from thorium nitrate in solution by means of precipitation, filtration and calcination since it is easier to control the particle size, surface area, etc. of the ThO_2. The aim of this talk is to show the approach of SCK•CEN to produce thorium carbides target materials with special focus on the properties of the raw materials.