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Uranium Carbide Target Material Development for the Production of Exotic Radioisotopes at ISOLDE-CERN

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ISOLDE is known to produce a large variety of more than 1000 radioisotopes of 73 different chemical elements throughout the chart of nuclides. Therefore a number of not less than 30 different target materials are currently in use or under intense development. Especially targets based on uranium and thorium refractory compounds have been at the heart of the ISOL technique since its first pioneer experiment in 1951, nowadays producing over 60% of the radioisotopes delivered at ISOLDE. Different developments took place along the years in the various facilities, and today porous uranium carbides with excess graphite phase are used throughout the different operating facilities. However little is known about the influence of their microstructure, crystallography, porosity and chemistry on the isotope release properties. Recently submicron, porous SiC [1], CaO and Y₂O₃ materials with improved exotic sodium, magnesium, krypton and argon yields [2] could be used without significant degradation over extended periods at ISOLDE, providing the first direct evidence that such kind of matrices can be used to improve the ISOL beam performance for exotic beams. Within the framework of ActILab in FP7-ENSAR: Integrating R&D on ISOL UC targets, several uranium carbide target materials are now under development with the objective to translate these recent findings. This is done by systematic investigations of the impact of phase composition, nano- or submicro-metric grain size, and porosity on their performance and stability [3,4]. This contribution will summarize recent investigations and major achievements in this field at ISOLDE.

[1] S. Fernandes, PhD thesis EPFL (2011), <http://cdsweb.cern.ch/record/1312950/>

[2] J. P. Fernandez Ramos, Nanostructured Calcium Oxide Targets for the Production of Argon Beams, ISOLDE Workshop and Users Meeting, CERN (2011)

[3] A. Gottberg, Online Tests of a High Density UC target at CERN-ISOLDE, ARIS (2011)

[4] A. Gottberg, Uranium Carbide Material Developments at CERN-ISOLDE, EURISOL-NET (ENSAR/NA03) Working Group Meeting (2011)

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