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Actinide targets at IPNO

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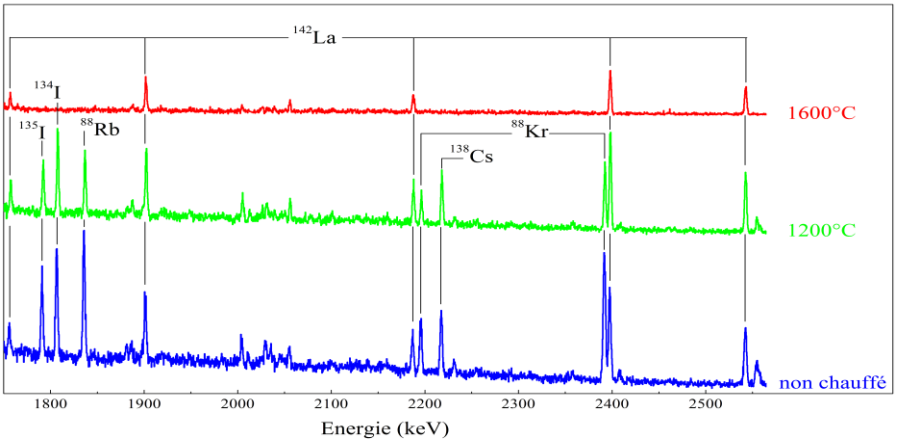
The Institut de Physique Nucléaire Orsay (IPNO) is strongly involved in the study of actinide targets for the production of neutron rich radioactive beams by the ISOL method (isotope separation on line) through active collaborations. IPNO has taken part in EURISOL-DS and is currently in charge of UC_x target developments within the Spiral2 project. An efficient collaboration has been set up with the Sciences Chimiques material laboratory of the University of Rennes (France). A MoU is being established between IPNO and Legnaro (Italy) within the SPES project. Experimental work is performed within the MoU existing between IPNO and Triumf (Vancouver, Canada). Lastly but not the least, IPNO is an active partner of both the ENSAR ActILab project and the Eurisol-net working group. Unfortunately, IPNO's ANR project Priscus was not granted this year.

The aim of the work pursued at IPNO is to increase the target density while improving the release properties. Different precursors are studied for the carboreduction process (uranium oxide and oxalate) along with the arc melting process of uranium and graphite. In parallel, studies on the electrochemical treatment of UCx material are starting in order to deal with the disposal of the targets. Construction is scheduled to start in September 2011 to extend the target laboratory at IPNO. This will enable us to separate the activities dealing with U at room temperature and at 2000°C. An air treatment unit will also be added.

Other fission materials will be investigated including binders for pressed powders, sol-gel synthesis in complex fluids and nanostructures. IPNO participated in the release tests at Isolde of the new dense UC target previously tested at Gatchina.

Characterizing the structure of the UCx targets is essential in order to gain a better understanding of their behavior. An experimental procedure was set up to test the release properties of single UCx pellets. This allows to discriminate between the various prototypes of UCx pellets leaving the on line experiment to the most promising of them. Two pellets of the same composition are irradiated together with neutrons delivered at the ALTO facility in IPNO. These neutrons result from the break-up of 20 nA 27 MeV deuterons impinging on a graphite converter. The activity of each pellet is then measured by gamma spectrometry. One of the pellet is then heated to 1200°C for one hour. Then once again the activity of each pellet is measured. The tests at 1200°C were carried out to demonstrate the feasibility of such a procedure.

The elements to be measured were chosen according to their lifetime, the heating time and the time it takes to transfer the pellets from the irradiation chamber to the furnace. The following elements were chosen after simulation calculations: Kr, Sr, Y, Ru, Sn, Sbn Te, I, Xe, Cs, La and Ce. The following figure shows the evolution of the intensity of some γ rays after heating at 1200°C and 1600°C.



A chamber is under development to test the release properties at 2000°C under vacuum.

Finally, the structural stability of the pellets after heating for over 400 hours was studied with MEB micrographs. Conclusions on the first samples were hard to draw because of the heterogeneity of the surface of the pellets.