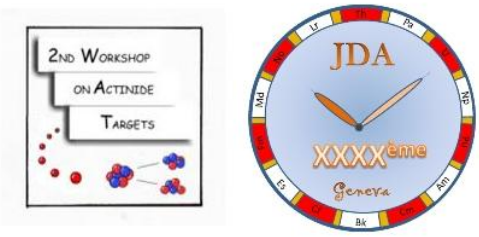

Contribution ID: **51** Type: **oral**

Recent progress in the synthesis and characterization of uranium carbide compounds

Sunday, 28 March 2010 09:40 (20 minutes)

The binary uranium-carbon phase-diagram comprises three intermediate phases (UC, U2C3 and UC2) showing high melting / decomposition points, high thermal conductivity, lack of phase-transformations at temperatures of practical relevance, and good stability under irradiations, which allow their use under extreme conditions. An enormous amount of work has been directed to those binary compounds as nuclear fuels for fast reactors operating at high temperatures or targets for high energy spallation or fission sources at ISOL facilities of new generation.
Both projects claim a significant gain of the efficiency of the future systems compared with the systems available to date, for this the two most important are the need to increase the life-time of the fuel or of the target and the need to use them at high temperatures (800-1000°C for GFR-He, compared to 300-450°C for current nuclear plants). The first reason is to limit the serious problem arisen for the replacement of the highly radioactive materials, the amount of nuclear wastes and to burn the minor actinides in the case of fuel. The increase of the working temperatures is directly linked to the efficiency of the fuel or of the target, but also it allows co-generation, in the case of Gen-IV nuclear plants.
For a decade, the research activities of our research group focused on the study of uranium, carbides, covering various aspects, such as the synthesis, the phase relations in the U –C binary phase-diagram, the microstructural characterization of the powders, and finally the sintering of these powders. In this presentation, a general description of these experimental tasks will be given. New results will be exposed and compared with literature data. The conclusion will focus on the most significant advances for the preparation of high purity powders of uranium carbides, by means of controlled key-parameters, that were identified as, U to C atomic ratios, temperature, partial pressure of the reaction chamber, time of the dwell.

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Session Classification: Materials I

Track Classification: Materials science, nanomaterials