Laser melting study of nanograined uranium carbides

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Introduction

UC2-y/C composites are world reference materials for ISOL spallation targets [1]. Recently, an increase of the radioactive ion beam intensities was observed on nanomaterials [2], but their basic properties are largely unknown. Here, we present a study of the high-temperature transitions of nanograined UC2-y with C and UO2 impurities, using laser heating.

Experimental

UC2-y samples prepared by electrospinning using solutions of cellulose acetate and uranyl salts on acetic acid and 2,4-pentanediol. Good precursors were obtained from uranyl acetate solutions with 15% wt. cellulose acetate.

Results

The pre-laser heated sample observation points to a partial melting during decomposition. EDS indicates the presence of U, O, and C, showing that the carbothermic reaction, UO2 + 4C → UC2-y + 2CO, was not completed. TEM images show 4 to 10 nm grain sizes.

XRD measurements confirm EDS results, showing that UC2-y, UO2 and C constitute the pre-laser heated material.

Conclusions

UC2-y materials consisting of UC2-y as major phase, plus UO2-y and C, with nanometric grain sizes, show a melting temperature of 2760 K, close to the previously reported data, pointing to a small effect of the grain size on it. Observations of post-laser heated samples revealed grain sizes slightly larger than the pre-laser heated ones, indicating excess carbon as an inhibitor of the grains growth.
