

ТЕЗИСЫ ДОКЛАДОВ

МЕЖДУНАРОДНАЯ КОНФЕРЕНЦИЯ «Перспективные материалы с иерархической структурой для новых технологий и надежных конструкций»

X МЕЖДУНАРОДНАЯ КОНФЕРЕНЦИЯ «Химия нефти и газа»

Томск

Издательский Дом ТГУ

2018

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DOI: 10.17223/9785946217408/299

EVALUATION OF T_{2g} BAND INTENSITY DISTRIBUTION ACROSS A SURFACE OF
AN UO₂ CERAMIC

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UO₂ uranium dioxide is one of the most extensively studied compounds for nuclear domains applications owing to a simple cubic fluorine structure that allows one to describe any finest structural effects, whether being associated with oxygen stoichiometry or irradiation damage. It is often an object of investigations via Raman spectroscopy, because this method is powerful for probing structural inhomogeneities due to its sensitivity to chemical bonds and even anisotropic strains in solids [1, 2]. Ceramical stoichiometric uranium dioxide is assumed to give the uniform Raman response within its grain cores due to its cubic structure and proper T_{2g} symmetry vibrational mode at ~445 cm⁻¹ [3, 4]. Whereas a frequency of the T_{2g} Raman signal remains unchanged with the crystalline orientation, its intensity varies with respect to the crystallographic axes.

Nevertheless, the Raman imaging inspection of an UO₂ ceramic, performed earlier, evidenced diverse surfacial inhomogeneities observed as noticeable alterations in both the T_{2g} intensities and maximum positions within a sample surface [5]. The T_{2g} intensity variation across grains (although appearing homogeneous in the optical image of the sample surface) was implied to refer to various grain orientations.

In this connection, the present study is aimed at attempting to clarify circumstances of the T_{2g} spectral parameter alterations, detected in [6], using an UO₂ ceramical disk (8 mm in diameter and about 500 μm in thickness, fabricated at CEA Cadarache), polished and treated at 1700°C in an Ar/H₂ atmosphere. First of all, the task is in testing a hypothesis that the above variations are owing to different crystallite orientations which can be seen from the distributions of the Euler's angles within the UO₂ ceramic surface, available through electron back-scattering diffraction (EBSD). EBSD is a powerful tool for examining ceramic textures and morphological peculiarities, estimating dimensions, shapes and crystalline orientations of grains--crystals constituting a specimen. The crystalline orientations can be found from the Euler angles sets that serve as the basic parameters for the Raman band intensity calculation. The second step is a comparative analysis of theoretical and experimental data through a reconstruction of the appropriate images and their visual inspection.

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