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EVALUATION OF T_{2G} BAND INTENSITY DISTRIBUTION ACROSS A SURFACE OF AN UO_2 CERAMIC

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UO_2 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 ingomogeneities 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 orentation, its intensity varies with respect to the crystallographic axes.

Nevertheless, the Raman imaging inspection of an UO_2 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 apprearing 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 UO_2 ceramical disk (8 mm in diameter and about 500 μm in thickness, fabricated at CEA Cadarache), polished and treated at 1700ºC in an Ar/H_2 atmosphere. First of all, the task is in testing a hypothesis that the above variations are owing to different cristallite orientations which can be seen from the distributions of the Euler's angles within the UO_2 ceramic surface, avaliable 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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