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► To cite this version:

Claire Onofri-Marroncle, Catherine Sabathier-Devals, Doris Drouan, Gaelle Gutierrez, M. Bricout, et al.. Dislocation changes under irradiation: a separated effect study. MRS Spring meeting 2022, May 2022, Honolulu, United States. cea-04911649

HAL Id: cea-04911649

<https://cea.hal.science/cea-04911649v1>

Submitted on 24 Jan 2025

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Dislocation changes under irradiation: a separated effect study

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Uranium dioxide is currently used as standard fuel for Pressurized Water Reactors. During in-pile irradiation the microstructure of the UO₂ fuel pellets is drastically modified. Several phenomena, such as radiation damage accumulation, fission product implantation and mechanical load occur simultaneously, for temperatures between 500 and 1000°C in normal conditions, depending on the position in the pellet. Due to the recoil of fission nuclei, extended defects are produced in the fuel, as well as bubbles. Mechanical stress could also induce dislocations, dislocation glides and rearrangements. It has been shown experimentally that a preferential growth of fission gas bubbles is acting on the dislocation line network. Hence, the study of these extended defects is a necessary step to better understand and *in fine* to simulate the behavior of fission gas bubbles under irradiation which is one of the most important parameter for the PWR safety.

Using a separate-effect approach, the current study attempts to clarify the influence of these various irradiation parameters (temperature, ion, energy, fluence, stress) on the extended defect change. This experimental study, performed for several years, is based on ion irradiations (JANNUS facilities in Orsay and in Saclay) and mechanical tests followed by TEM characterizations.