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Microstructural characterization of U-7,5Nb-2,5Zr alloy after ageing and constrained fatigue

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U-7,5Nb-2,5Zr clad in zircaloy-4 is one of the most studied fuel prototypes. The Nb and Zr are added to the U to stabilize the BCC gamma phase and grant mechanical and swelling resistance. The U-7,5Nb-2,5Zr undergoes the gamma to alpha" phase transformation, generating compressive stresses due to the volume reduction. The alpha" phase also can transform to a combination of alpha+gamma2 phase (equilibrium phases), which are known to be hard and brittle. This work has the objective to test the effect of ageing the gamma to alpha" phase in thermal cycling of a U-7,5Nb-2,5Zr clad in zircaloy-4 piece. A co-limited specimen was aged and thermally cycled in a dilatometry experiment. The samples were characterized through X-ray diffraction and metallography. The results show that the gamma to alpha" phase transformations occur at the beginning of the initial ageing, followed by stress relief. During the cycling, the sample demonstrated non-equal thermal strains and presented fractures along with the U matrix.