

## Plastic Strain Accumulation Due to Asymmetric Cyclic Loading of Zircaloy-2 at 400°C

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**Abstract :** Asymmetric stress cycling leads to accumulation of plastic strain which is called as ratcheting strain. The problem is generally associated with nuclear fuel cladding materials used in nuclear power plants and pressurized pipelines. In the present investigation, asymmetric stress controlled fatigue tests were conducted with three different parameters namely, mean stress, stress amplitude and stress rate (keeping two parameters constant and varying third parameter) to see the plastic strain accumulation and its effect on fatigue life and deformation behavior of Zircaloy-2 at 400°C. The tests were conducted with variable mean stress (45-70 MPa), stress amplitude (95-120 MPa) and stress rate (30-750 MPa/s) and tested specimens were characterized using transmission and scanning electron microscopy. The experimental results show that with the increase in mean stress and stress amplitude, the ratcheting strain accumulation increases with reduction in fatigue life. However, increase in stress rate leads to improvement in fatigue life of the material due to small ratcheting strain accumulation. Fractographs showed a decrease in area fraction of fatigue failed region.

**Keywords :** asymmetric cyclic loading, ratcheting fatigue, mean stress, stress amplitude, stress rate, plastic strain

**Conference Title :** ICGHOST 2020 : International Conference on Ghost Conference

**Conference Location :** ghost city, Other

**Conference Dates :** December 12-13, 2020