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Abstracts

The recent literature on multiaxial fatigue has reported that fatigue life evaluated by the von Mises stress is overestimated and that magnitude varies depending on the loading path. In this study, multiaxial fatigue tests were carried out to clarify the controlling factors in failure life. Stress-controlled multiaxial fatigue tests were carried out using hollow cylinder specimens of type 430 and 316 stainless steel. A newly developed fatigue testing machine that can apply push-pull, reversed torsion, and inner pressure loading to the hollow cylinder specimen was employed. Seven types of cyclic loading paths, consisting of axial or hoop tension stress or a combination thereof, were employed: the Pull, the Inner pressure, the Push-pull, the Equi-biaxial, the Square-shape, the L_T-shape, and the L_C-shape loading paths.

Since the directions of principal stresses were fixed in all the tests, all the loading paths were classified as "proportional loading." Failure life varies depending on the loading path when evaluated by a maximum equivalent stress based on von Mises. The failure lives of the Square-shape, the L_T-shape, and the Push-pull tests are overestimated significantly compared to the Pull test. A stress range that considers the directional change of shear stresses could be used to evaluate failure life. Validity was also examined by crack observation and finite element analysis.

Keywords: Multiaxial fatigue; Inner pressure; Stainless steel; Proportional loading; Loading paths