Study on low cycle fatigue property for a hydrogen pre-charged to 316L stainless steel

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Abstract

A hydrogen is expected to play a major role as a storing and energy carrier. Sufficient infrastructure is required to operate a hydrogen fuel cell electrical vehicle in a stable manner. However, due to the expensive materials cost, the hydrogen charging station is very expensive and can not be built easily. Some cheap metal materials are exposed to hydrogen gas environment, resulting in hydrogen embrittlement, resulting in parts using expensive materials that are relatively resistant to hydrogen embrittlement. Therefore, if cheap metal materials can be properly designed and used, the price of hydrogen charging stations can be lowered. For proper design, research is needed on how cheap materials can withstand hydrogen embrittlement. Among them, the reliability of the pressure vessel in which repetitive confluence and release are performed depends on the fatigue characteristics. However, it is very complicated and difficult to measure the fatigue characteristics under a high pressure hydrogen gas environment. Therefore, in this study, after immersing austenitic stainless steel 316L in a high temperature and high pressure environment, sufficient permeation of hydrogen into the entire specimen was maintained to be stabilized. The low - cycle fatigue test was performed in the atmosphere using hydrogen - pretreated specimens and compared with the samples not loaded with hydrogen. As a result of the test, the life of the sample with large deformation was shorter than that of the sample without hydrogen. However, the test specimens with small deformation showed no difference in life span between the specimens not charged with hydrogen.