1 Environment Effects on Creep Crack Growth Behaviour

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1.2 Project Description

Life extension of the UK's advanced gas cooled reactors (AGRs) is dependent on the assurance of the safety of their structural components. As many AGR components operate in the creep range, it is important to understand and to be able to predict creep and creep-fatigue crack growth for real or postulated defects in these components. These components operate at high temperatures and are influenced by their environments including CO_2 coolant and steam.

In most cases, uniaxial creep and creep crack growth properties are obtained by testing specimens in a laboratory air environment. However, many AGR components are exposed to the pressurised AGR carbon dioxide (CO2) coolant and it is therefore important to understand how creep crack growth rates in this environment compare with those observed in a laboratory air environment. In addition, it is important to understand the relative contributions of creep and the presence of the environment to the crack growth tests conducted previously in a laboratory air environment.

The aim of this project is to investigate the creep crack growth behaviour of Type 316H steel in both a pressurised simulated AGR CO2 environment and an inert environment or vacuum to discover the significance of any environmental contributions to creep crack growth in both a laboratory air environment and a pressurised simulated AGR CO2 environment. In order to understand the effect of different environments on creep crack growth behaviour, it will be necessary to conduct a programme of new creep crack growth tests in a pressurised simulated AGR CO2 environment and either an inert environment or vacuum. It will also be necessary to conduct some new creep crack growth tests in a laboratory air environment for comparison with the large body of data that is already available for Type 316H steel, using modern techniques. Post-test metallurgical examination of a number of creep crack growth specimens tested in different environments will be performed to investigate how the environment interacts with the creep crack process.