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Fatigue Crack Growth of 316NG Austenitic Stainless Steel Welds at 325℃

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Abstract:

316NG austenitic stainless steel is a commonly-used material for primary coolant pipes of pressurized water reactor systems. These pipes are usually joined together by automated narrow gap welding process. In this study, welds were prepared by narrow gap welding on 316NG austenitic stainless steel pipes, and its microstructure of the welds was characterized. Then, fatigue crack growth tests were conducted at 325℃. Precipitates enriched with Mn and Si were found in the fusion zone. The fatigue crack path was out of plane and secondary cracks initiated from the precipitate/matrix interface. A moderate acceleration of crack growth was also observed at 325℃air and water (DO=~10ppb) with *f*=2Hz.

Key words: 316NG austenitic stainless steel welds, pressurized water reactor, fatigue crack growth

1. Introduction

316NG austenitic stainless steel is a candidate materials for the primary coolant pipes of advanced pressurized water reactors (PWRs). In this application, 316NG austenitic stainless steel pipe sections are welded by narrow gap welding (NGW) technology to fabricate the primary coolant piping system. The accumulated operating experience of PWRs reveals that the primary coolant piping system may be subject to fatigue cracking [1].

Many studies have been carried out to understand the fatigue behavior of the primary coolant piping materials such as 316L, 316LN and 304L in PWR