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In situ fretting fatigue crack propagation analysis using Synchrotron X-ray radiography

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Abstract

The aim of this work is to study the initiation and propagation of fatigue cracks during fretting tests in partial slip conditions, and to compare the fretting fatigue behaviour to conventional fatigue C(T) crack growth experiments. An experimental device is specially developed in order to perform in situ fretting fatigue tests at a synchrotron facility. 2D radiographs of fretting fatigue cracks are directly observed in situ for the first time for a cylinder/plane contact configuration. FE computations are carried out to calculate stress intensity factor range ΔK at the crack tip for the complex loading configuration, revealing short and long crack propagation behaviours.

Keywords: Fretting Fatigue; Crack growth propagation; In situ tests; Synchrotron; Radiography

1. Introduction

Fretting occurs every time two contacting bodies experience a relative tangential displacement usually caused by oscillating forces or vibrations. Combined with cyclic bulk fatigue loading, the so called fretting fatigue critically reduce the fatigue endurance whatever the materials [1]. This phenomenon is a key issue for safety-critical component in

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