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# Very high cycle fatigue property of high-strength austempered ductile iron at conventional and ultrasonic frequency loading

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## Abstract

In this study, the very high cycle fatigue tests were conducted on a kind of high-strength austempered ductile iron (ADI) at 90 Hz and 20 kHz. The S-N curves decrease continuously and there is no fatigue limit in the very high cycle fatigue regime. **The fatigue strength of the different frequencies essentially corresponds with each other and the specimens show similar fracture behaviors.** Meanwhile, on the fracture surfaces of some specimens, the ‘granular-bright-facet’ (GBF) area is observed. The threshold stress intensity factor for internal crack growth is obtained and the fatigue limit is evaluated based on the defect size.

**Key words:** Austempered ductile iron; Very high cycle fatigue; Loading frequency; Defect size

## 1. Introduction

In recent years, much attention has been drawn to the properties of materials in very high cycle fatigue (VHCF,  $10^6$ – $10^9$  cycles) regime [1-4]. Lots of investigations have been conducted and results show that specimens can fracture from internal zone at over  $10^7$  cycles, which makes the conventional fatigue limit disappear. However, the VHCF tests up to  $10^9$  cycles with conventional fatigue testing machines at a frequency of 90 Hz will take more than four months, while, with the

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