Torsional fatigue behaviour and damage mechanisms in the very high cycle regime

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The fatigue of materials in the very high cycles (VHCF) regime (>107 cycles) has been studied in the past 20 years to understand the fatigue damage mechanism of mechanical parts subjected to very high vibrations [1-4]. Recent works using ultrasonic fatigue testing devices (20-30 kHz) have shown that many materials, including some steel, aluminium alloy and titanium alloys, intermetallics composites, etc., exhibit a sharp decrease in the fatigue strength between the fatigue lives of 106 and 109 cycles [1-9]. Hence, it is important to investigate the fatigue behaviour of materials in this very high cycle regime. Several fatigue investigations in the VHCF range of the metallic materials have shown that damage initiated in the very high cycle fatigue ranges well below the traditional fatigue limit, which was predicted by the “classical Wöhler S-N curve” as alluded to in Ref 1-39.

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