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The High Cycle Fatigue, Deformation and Fracture of Compacted Graphite Iron: Influence of Temperature

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Abstract:

The microstructure, tensile strength, high-cycle fatigue property and corresponding damage mechanisms of compacted graphite iron at room temperature (25 °C), 400 °C and 500 °C, were investigated. It is found that the fatigue strength increases at first and then decreases with the increase of the testing temperature. At 25 °C, the fatigue crack mainly initiates from graphite debonding and propagates along the graphite clusters. At 400 °C, the fatigue crack initiation is influenced by oxidation; the fatigue strength may be improved by dynamic strain aging. At 500 °C, the oxidation becomes more serious and the oxide layer accelerates the crack to propagate along the matrix. At the same time, the phenomenon of grain boundary softening, one of the reasons resulting in the reduction of fatigue strength, is found. Then, the model of damage mechanism was proposed according to the propagation behavior of fatigue crack at high temperatures, and the quantitative relationship between the fatigue strength and the ratio of the interphase corrosion depth to the critical crack length was established. This investigation may enrich the fundamental understanding on the damage mechanism of compacted graphite iron.

Key words: Compacted graphite iron; Testing temperature; High-cycle fatigue property; Oxidation effect; Dynamic strain ageing.

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