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Fatigue crack growth in compacted and spheroidal graphite cast irons

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Abstract

Fatigue crack propagation resistance has not been thoroughly explored especially for the Compacted Graphite cast Iron (CGI) that contains graphite with a vermicular shape. Hence, the present paper focuses on the fatigue life of a CGI SiMoNi as compared to a Spheroidal Graphite cast Iron (SGI) SiMo, already studied and well known in the literature. Fatigue crack growth laws have been determined on single edge notch tension standard specimens with the help of digital image correlation. Main differences between the two materials are that cracks propagate much faster in the CGI than in the SGI with also lower toughness and crack propagation threshold. For a comprehensive analysis of the mechanical behaviour, a three-dimensional quantitative analysis of the complex 3D morphology of graphite is mandatory. Therefore, X-ray microtomography has been used to provide complete and unbiased information of the spatial arrangement and geometry of graphite particles. A characterisation of the graphite morphology with estimation of basic shape parameters (volume, surface area, Feret diameter...) was performed. A complex morphology, with a high level of connectivity, was observed for the vermicular graphite but with rounded edges that limit partially the notch effects noticed in the case of flake

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