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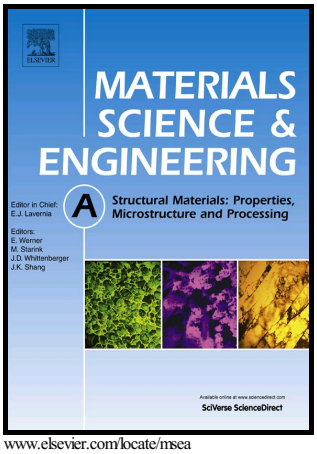

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Non-inclusion induced crack initiation in multiphase high-strength steel during very high cycle fatigue

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Abstract

During very high cycle fatigue (VHCF) crack can initiate at non-inclusion site in the interior of Mn-Si-Cr bainite/martensite (B/M) multiphase steels. The characteristics of non-inclusion induced crack initiation in B/M multiphase steels and the relationship between the size of granular bright facet (GBF) and VHCF limit were studied through ultrasonic fatigue testing, in terms of fracture surface analysis, crack initiation analysis, and failure mechanism. The current study reveals that GBF area became smaller with the increase of VHCF limit, i.e. the steel with higher fatigue-endurance strength exhibited smaller GBF area in the case of steel characterized by non-inclusion crack initiation in the VHCF regime. The relationship between GBF area, fatigue life, and applied stress was consistent with the following equation $\sqrt{area_{\mathrm{GBF}}}$ =29.41LogN_f - 0.2916σ_a +47.51. The study provides an understanding of non-inclusion induced crack initiation in VHCF and a guidance for steel fatigue design.

Keywords: Very high cycle fatigue, Bainite/martensite multiphase steel, Non-inclusion induced crack initiation.

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