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Numerical Study on the Fatigue Crack Propagation Behavior in Flattened Martensite Dual Phase Steel

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Summary: The impedance and phase characteristic of a magnetic thin film changes when a magnetic field is applied. The high-frequency-carrier magnetic field sensor, also called a GMI sensor, employs this phenomenon as its principle. We directed our attention to the chThe relation between the fatigue crack propagation behavior and the microscopic characteristics (the morphology, distribution, hardness of the 2nd phase) of Ferrite / Martensite Dual Phase steel is investigated numerically by using Crystalline-Elastic-Plastic F.E. (CPFE) analysis. As results, followings are found; 1) Under the conditions chosen, the crack closure level increases and CTOD decreases as a crack tip approaches the martensitic phase (M-phase) boundary. These changes become more pronounced when the hardness of M-phase becomes higher. 2) Under the conditions chosen, the J-integral of a crooked crack becomes nearly equal to that of a straight crack when the initial crack tip is located adjacent to the M-phase border. 3) Under the conditions chosen, the driving force of crack propagation of a fatigue crack which propagates in a narrow ferrite slit in M-phase is equal to or greater than that of a crack which propagates in a wide ferrite phase. 4) The calculation results lead us to a prediction that the crack growth rate of a Ferrite / Martensite Dual Phase steel with polygonal and banded M-phase becomes much higher than that with flattened (elongated) and banded M-phase because cracks can slip through M-phase when there exist narrow ferrite slits. The experimental results obtained by Nakashima et al. (2003) agree approximately with this prediction. This demonstrates the validity of the CPFE theory

employed in this research.

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