Effects of stress cycles on surface magnetic field

Chen X., Li L.M., Yang E., Huang X.F.
NDT Center, Mechanical Engineering Department, Tsinghua Univ., Beijng 100084, China

Abstract: The change of magnetic flux as a function of applied tensive stress has been investigated under geomagnetic field for a cuboid specimen of 0.45% wt C steel. A hole was drilled in the center of the specimen to generate stress concentration and the stress concentration of the specimen was theoretic calculated. The magnetic flux near the surface was measured using a reluctance effect sensor with sensitivity of 2×10-5 Gs in directions parallel and perpendicular to tensile direction. To each specimen magnetic field distributions of 9 stress cycles, amplitude form 0kN to 120kN, were measured. The results showed a reversible dependence of this field on tensile after the first few stress cycles. Correlation coefficients of these data also show this trend. During the cycles, domain motion and rotation occurred in response to tensile stress. This change included reversible and irreversible process. After several tensile cycles at same stress amplitude, all irreversible components were overcome and the change of magnetic field became mostly reversible. Comparing with the previous work, the reversible magnetic field versus tensile stress shows clearer and more valuable relationship between stress and field.
Author Keywords: Magnetic field; Magnetic flux; Reluctance effect sensor; Reversible; Stress cycle

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Authors with affiliations:

1. Chen, X., NDT Center, Mechanical Engineering Department, Tsinghua Univ., Beijng 100084, China
2. Li, L.M., NDT Center, Mechanical Engineering Department, Tsinghua Univ., Beijng 100084, China
3. Yang, E., NDT Center, Mechanical Engineering Department, Tsinghua Univ., Beijng 100084, China
4. Huang, X.F.