

微小欠陥を含む部材の応力腐食割れおよび破壊靱性に関する研究

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1987 Fiscal Year Final Research Report Summary

Stress Corrosion Cracking and Fracture Toughness of Materials with Short Cracks

Research Project

Project/Area Number

61550052

Research Category

Grant-in-Aid for General Scientific Research (C)

Allocation Type

Single-year Grants

Research Field

機械材料工学

Research Institution

Kanazawa University

Principal Investigator

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Keywords

An AC electrical potential system / Short crack / Notched specimen / Stress corrosion cracking / Fracture toughness / 破壊靱性値 / X線残留応力 / 有効応力拡大係数範囲

Research Abstract

An AC electrical system with a lock-in amplifier was developed to measure the specimen of crack in notched specimens of a high strength steel. This system was successfully used to measure the crack length during SCC and fracture toughness tests. Crack propagation tests were conducted both in air and in 3.5% NaCl solution. Residual stress near the fracture surface were measured by X-Ray diffraction method. The results obtained are summarized as follows;

(1) Although the growth rate of short cracks was higher than that predicted from the rate- ΔK relation for long cracks, it was uniquely related to the effective stress intensity factor range and the relation was identical for long cracks.

(2) The residual stress measured on the fracture surface was tension both in air-fatigue and corrosion fatigue. The maximum depth of the plastic zone was evaluated on the basis of the residual stress distribution. The depth y is related to K_{max} by the following equation: $\alpha (K_{max}/\Delta y)^2$

where Δy is the yield strength obtained in tension tests. α is 0.19 for air fatigue and 0.06 for corrosion fatigue. The small value of α in

corrosion fatigue suggests the hardening of the material in the plastic zone due to the environmental effect.

Research Products (13 results)

All Other

All Publications (13 results)

- [Publications] 広瀬幸雄: Residual Stresses in Science and Technology Edited by E.Macherauch and V.Hauk. 1987II. 721-728 ▼
- [Publications] 広瀬幸雄: Mechanical Behavior of Materials-V Edited by M.C.Yan,S.H.Zhang,Z.M.Zheng. 1987II. 551-558 ▼
- [Publications] 広瀬幸雄: 材料. 36. 805-809 (1987) ▼
- [Publications] 広瀬幸雄: 日本材料強度学会誌. 22. 106-114 (1987) ▼
- [Publications] 広瀬幸雄: Advances in X-Ray Analysis.31. (1988) ▼
- [Publications] 広瀬幸雄: Engineering Fracture Mechanics. 28. (1988) ▼
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- [Publications] Yukio Hirose: "Load-History Effect on Initiation of Stress Corrosion Cracking in High Strength Steel" Residual Stress in Science and Technology, Edited by E. Macherauch and V.Hauk.II. 721-728 (1987) ▼
- [Publications] Yukio Hirose: "X-Ray Examination of Fatigue Fracture Surfaces of Nodular Cast Iron," Mechanical Behavior of Materials-V, Edited by M.G. Yan, S.H. Zhang, and Z.M. Zheng,. II. 551-558 (1987) ▼
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