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AEC-NASA TECH BRIEF

Failure in Glass

A comprehensive review of the state of the art concerning glass failure mechanisms and fatigue theories discusses, in detail, brittle fracture in glass, fatigue mechansims, fatigue behavior, environmental effects on failure rate, and aging. Furthermore, a statistical analysis of glass failure is presented.

The review indicates that at lower stresses fatigue occurs as a result of a thermally activated chemical reaction that forms silanol sites on the glass surface behind the propagating crack. At higher stresses the reaction appears to be transport controlled and is not thermally activated. The rate of fatigue depends on both the type and size of flaws and on the medium in contact with the glass.

The most likely fatigue mechanism in a water environment appears to be the formation of silanol sites on the glass surface. The sites are formed by hydrogen ions reacting with unbonded (or partially bonded) oxygens or by hydroxyl ions reacting with unbonded silicons. This reduces the Si-O bond strength in the immediate neighborhood of the site.

The review is augmented by inclusion of 110 references concerning fatigue or failure in glasses.

Notes:

1. The following documentation may be obtained from:
   National Technical Information Service
   Springfield, Virginia 22151
   Single document price $3.00
   (or microfiche $0.95)

   Reference: SCL-RR-710010 (N71-34510), Delayed Failure in Glass

2. Technical questions may be directed to:
   Mr. Glenn K. Ellis
   Technology Utilization Officer
   Office of Information Services
   U.S. Atomic Energy Commission
   Washington, D.C. 20545
   Reference: TSP72-10364

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