NASA TECH BRIEF

Lewis Research Center

Life Prediction of Materials Exposed to Monotonic and Cyclic Loading: A Technology Survey and Bibliography

A continuing program of research into the behavior of metals, alloys, and composite materials at high temperatures has contributed substantially to the development of present-day high performance, highly reliable jet aircraft engines. The development of better materials has permitted higher engine operating temperatures with accompanying higher thrust levels and lower fuel consumption. An understanding of the behavior of materials at high temperatures and subject to stress and fatigue, applied to life prediction, has allowed the utilization of their capabilities with high reliability and maximum operating time schedules.

A great deal of progress has been made in understanding the high temperature behavior of materials. A considerable body of information has been accumulated which can be profitably applied in many areas, particularly in selecting materials which can survive and function satisfactorily in high temperature environments. A technology survey and bibliography have been assembled to provide ready sources of information on the life prediction of materials.

The technology survey comprises an overview which summarizes the development of high temperature material behavior technology and evaluated abstracts of about 100 significant reports, with references, covering the period from 1962 to 1974. Primary attention is directed toward low cycle fatigue and thermal fatigue experienced at elevated temperatures equivalent to those found in the hot end of a gas turbine engine. Other environmental regimes are also covered. Emphasis is given to nondestructive testing.

The bibliography comprises approximately 1200 references over the same time period related to the mechanics of failure in aerospace structures. The majority of the references are on life prediction for materials exposed to monotonic and cyclic loading in high temperature environments. Additional references are on radiation effects on high temperature mechanical properties of materials and on high cycle fatigue technology applicable to gas turbine engine bearings.

Notes:

1. These two documents have been published as:

   NASA CR-134750 (N75-21669), Life Prediction of Materials Exposed to Monotonic and Cyclic Loading - A Technology Survey

   NASA CR-134751 (N75-21668), Life Prediction of Materials Exposed to Monotonic and Cyclic Loading - Bibliography
2. Also, a Register of Experts on the Mechanics of Structural Failure has been assembled comprising some 300 people from 90 organizations who have recently published the results of theoretical and/or experimental research related to: life prediction for structural materials, fracture toughness testing, fracture mechanics analysis, hydrogen embrittlement, protective coatings, and composite materials. The register provides sources of expert information on failure modes and mechanisms. Each expert is listed by organizational affiliation, address, and principal field of expertise. Criteria for selection of the names were recent contributions to the literature, participation in or support of relevant research programs, and referral by peers. It is recognized as an incomplete listing but should be useful as a guide to those who seek related information. This register has been published as:

   NASA CR-134754 (N75-22187), Register of Experts for Information on Mechanics of Structural Failure
3. Additionally, a Technology Survey and a Bibliography have been assembled on Fracture Toughness Testing Data (announced in NASA Tech Brief 75-10139). These two documents have been published as:

   NASA CR-134752 (N75-18625), Fracture Toughness Testing Data - A Technology Survey

   NASA CR-134753 (N75-18610), Fracture Toughness Testing Data - A Bibliography

(continued overleaf)

4. All of these documents may be obtained at cost from:
   Aerospace Research Applications Center
   Indiana University
   400 East Seventh Street
   Bloomington, Indiana 47401
   Telephone: 812-337-7833
   Reference: B75-10138
5. Specific technical questions may be directed to:
   Technology Utilization Officer
   Lewis Research Center
   21000 Brookpark Road
   Cleveland, Ohio 44135
   Reference: B75-10138
6. NASA's Aerospace Safety Research and Data Institute, located at the NASA Lewis Research Center, collects, evaluates, and organizes safety-related information for use by NASA and others. The documents announced in this Tech Brief have been compiled and published as part of this effort.

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