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NASA TECH BRIEF

Study Made of Procedures for Externally Loading and Corrosion Testing Stress Corrosion Specimens

A study was initiated because there are no specific methods or special test specimens for evaluating the stress corrosion cracking characteristics of the common structural materials such as those used for determinining mechanical properties. In general, the investigator is at liberty to choose the types of specimens and corrosive environments for conducting stress corrosion tests. This usually leads to conflicting published results which are confusing to the designer in appraising the susceptibility of various materials to stress corrosion cracking.

Other uses of stress corrosion test data, in addition to the selection of structural material by the designer, are in developing alloys, maintaining uniformity of products, and determining new applications for specific structural materials. It is doubtful if any single stress corrosion test procedure would be suitable for evaluating all common structural materials or all service environments. However, standard stress corrosion test procedures are necessary to obtain comparable results among investigators.

There is little doubt that the most reliable method of stress corrosion testing is to expose the material in the specific atmosphere of service environment. This method, however, is far too time consuming, and it is necessary to use an accelerated test environment to obtain results within a reasonable period of time. It is of paramount importance that the accelerated test environment be realistic of general service conditions and yield reproducible results.

The type and geometry of the material and the grain direction to be tested are some of the major factors to be considered in choosing the specimen designs for stress corrosion tests. In most cases, specimen design must be based on the geometry of the material to be evaluated. For instance, flat tensile specimens normally are used for testing sheet material; for thick plate and forging, round specimens can be used; weldments generally require relatively thick specimens with the as-welded surfaces intact.

During the course of the study, it was found that the types of specimens described and the methods of externally loading and corrosion testing were reliable in yielding reproducible results for stress corrosion evaluation of most aluminum alloys, and have shown promise for ferrous and nickel alloys. More consistent results have been obtained with the threaded-end tensile specimens, stressed by constant deformation, than have been obtained with specimens (flat tensile, beam specimens, and C-rings) stressed by constant deflection.

Note:

Additional details are contained in: *Procedures for Externally Loading and Corrosion Testing Stress Corrosion Specimens,* TM-X-53483, by T. S. Humphries, Marshall Space Flight Center, June 29, 1966. Copies are available from:

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Patent status:

Inquiries about obtaining rights for the commercial use of this invention may be made to NASA, Code GP, Washington, D. C. 20546.

Source: T. S. Humphries
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Category 03