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NASA TECH BRIEF

Evaluation of a Fluorocarbon Plastic Used in Cryogenic Valve Seals

Tests were conducted to determine the independent and interacting effects of strain rate, temperature, crystallinity, and surface finish (smoothness) on the tensile strength of a commercial chlorotrifluorethylene plastic (CTFE) used for lipseals in very fast-acting liquid oxygen valves. The tests were statistically designed to provide the maximum amount of significant data with a minimum number of test specimens.

Approximately 200 tests were performed at strain rates between 0.02 and 10,000 inches per minute and temperatures of 75° and −320°F. Specimens of CTFE representing two different crystalline aggregates and two surface finishes were subjected to the tests.

Analysis of the test data showed that temperature and strain rate had the most significant effect on the tensile strength of the material. Surface finish and crystallinity were relatively less significant. The effects of high strain rate on tensile strength were not the same at ambient (75°F) and cryogenic temperatures. The specimens appeared to fail in a two-step process at a strain rate of 10,000 inches per minute. Additional tests would be required at a temperature of −320°F and at strain rates between 1000 and 10,000 inches per minute to determine whether the maximum tensile strength gradually decreases as the strain rate increases or whether it rapidly decreases at some critical strain rate. From the present data, however, it was concluded that machined medium-crystallinity seals can be used as a less-expensive replacement for molded low-crystallinity seals in fast-acting cryogenic-propellant valves.

Note:

Details may be obtained from:

Clearinghouse for Federal Scientific
and Technical Information
Springfield, Virginia 22151
Price $3.00
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Patent status:

No patent action is contemplated by NASA.

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