NASA TECH BRIEF

Fractography Can Be Used to Analyze Failure Modes in Polytetrafluoroethylene

Techniques for analyzing failures in metals are well established, and an abundance of data on failure modes in these materials is available. Fractography has been a common analytical technique for studying the fracture face of a failed metal by means of both macro- and micro-photography. The minute topographical features revealed in the fractographs are then compared with standards which were fractured under controlled conditions. Similarities between the fractographs representing service failures and the standards indicate the failure mode.

A study was undertaken to determine the feasibility of applying fractographic principles used for metals to the analysis of the microstructure and fracture characteristics of polytetrafluoroethlene (PTFE), a material used as seals in cryogenic systems. Notched and unnotched samples of 1/4-inch-thick PTFE were prepared and tested in tensile and fatigue testing machines at room temperature and at the temperature of liquid nitrogen. The test conditions approximate the stress and temperature environments to which the PTFE would be exposed in space systems hardware. Replicas of the fractured surfaces were prepared by the commonly used two-stage acetate replica technique. All fractures were studied in two magnification ranges: the macro-range, from 1 to 10×; and the micro-range, from 3500 to 15,000× (with the electron microscope). The various topographical features noted on the fracture faces were defined in terms of observable patterns (chevrons, dimples, tears, ridges, and striations) and tabulated for all samples.

The results of the study demonstrate that fractography can be used to analyze fractured surfaces of PTFE to determine modes of failure in this material.

Note:

Documentation is available from:

Clearinghouse for Federal Scientific and Technical Information
Springfield, Virginia 22151
Price $3.00
Reference: TSP69-10066

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: B. H. Nerren
(MFS-20294)

Category 03