NASA TECH BRIEF

Hydrostatic Testing of Porous Assemblies

The problem:

Determining the actual rupture strength of porous assemblies subjected to hydrostatic loads presents severe problems in terms of fixturing and loading. Any blocking fixture configuration for porous material is likely to carry some of the applied test load, thus invalidating the test data. In many cases, the flow area of the porous material is too large to permit sufficient pressure buildup with any conventional pressurizing equipment.

The solution:

The pores of the material are plugged with dust particles suspended in water, and the hydrostatic test is conducted by conventional methods.

How it's done:

The plugging material used was a standard test dust prepared as a slurry in distilled water. The dust is graded in the following nominal proportions: 0 to 5 microns, 12 percent; 5 to 10 microns, 12 percent; 10 to 20 microns, 14 percent; 20 to 40 microns, 23 percent; 40 to 80 microns, 30 percent; and 80 microns, 9 percent. The slurry is forced into the porous material under pressure until the material is completely plugged. This generally requires four or five pressure surges to obtain complete sealing. The assembly can then be hydrostatically tested to rupture using any conventional test fluid.

This technique provides a permanent high-integrity seal for porous material without affecting its physical properties, yet permitting pressure testing to verify structural adequacy. If nondestructive testing is desired, a similar size mix of hard microspheres (carbides or oxides) may be substituted for the material dust. The hardness and sphericity reduce the severe wedging of the particles under high pressure and eliminate particle deformation. The microspheres will permit removal of the material by high-pressure back flushing, followed by ultrasonic cleaning.

Notes:

1. Accurate determination of the structural properties of porous materials frequently used in various fluid systems will permit substantial design refinement of many common items of industrial and processing equipment. Typical examples are filters, spargers, acoustic liners or covers, permeable separators, and porous tank or reactor walls.
2. Questions concerning this process may be directed to:

   Technology Utilization Officer
   Marshall Space Flight Center
   Huntsville, Alabama 35812
   Reference: B68-10439

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: W. L. Bigelow
of North American Rockwell Corporation
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Category 05