

NASA TECH BRIEF

Ames Research Center

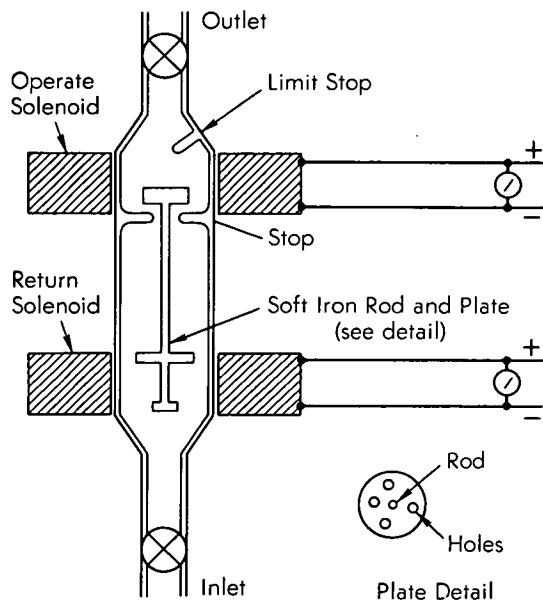


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Electromagnetic Rheometer

The problem:

To measure the degree of structure of propellant gel systems.



The solution:

Determine the force required to pull free a small circular plate that has been imbedded in the gel liquid. For remote operation and for simplicity, the plate is pulled by an electromagnet.

How it's done:

The rheometer consists of a glass tube inside of which is a soft iron rod and perforated plate. The rheometer is mounted within two solenoids as indi-

cated in the diagram; the magnets are used to pull the soft iron rod and plate through gels. Voltmeters attached to the input lines to the magnets are used to give an indication of the force exerted on the soft iron rod and plate. The entire apparatus can be heated or cooled as required; the upper limit stop can be used as an electrical contact to indicate when the iron rod has reached the limit of its upper travel.

The procedure for measuring the structure of a gel is as follows: The tube is filled with a gel and the return solenoid is energized to pull the inner rod down to the stop; then the solenoid current is interrupted. The upper solenoid is then energized in small step-wise increments until the magnetic field is just strong enough to start the soft iron rod moving through the gel. The voltage applied to the solenoid is recorded.

The structure index is computed as follows:

$$\text{Structure Index} = (G - N) (98.07)W/AE$$

where G = volts required to move the rod and plate in the gel,

N = volts required to move the rod and plate in neat liquid,

E = volts required to move the rod and plate in empty rheometer,

W = weight of the rod and plate in grams,

A = area of the rheometer plate, in m^2 ,

and the structure index is in newtons per square meter.

The following table shows correlation of the structure index obtained by a prototype electromagnetic rheometer and the sphere method; the data were obtained on a series of water gels.

(continued overleaf)

Sample	Structure Index, N/m ²	
	Sphere Method	Electromagnetic Rheometer
A	110	95
B	150	155
C	175	190
D	190	205
E	250	255

Although the values obtained with the electromagnetic rheometer are not absolute, they can be used as a relative indicator of gel structure.

Notes:

1. NASA Tech Brief B72-10026 describes a similar rising-plate rheometer suitable for gel structure

determinations.

2. No additional documentation is available. Specific questions, however, may be directed to:
 Technology Utilization Officer
 Ames Research Center
 Moffett Field, California 94035
 Reference: B72-10416

Patent status:

No patent action is contemplated by NASA.

Source: Robert H. Globus and
 Jackie A. Cabeal of
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