NOTES

A Modified Environmental Stress-Cracking Apparatus for the Liquid and Gas Phases

The study of the environmental stress cracking of polymers generally requires various apparatuses.[1-4] The apparatuses that are used for experiments in the stress cracking of polymers in detergents are not completely satisfactory for such "in between" materials, the conditions for which may traverse the entire gamut between the solid and liquid phases, depending on the concentration of detergent, the temperature and the time experiment. Furthermore, the stress cracking of polymers in solid–liquid or solid–gas systems has not been thoroughly investigated. Therefore, the author has had to develop a suitable apparatus that is more convenient and inexpensive than the usual ones.

The sample for examination in this apparatus was a film; see (*1*) in Figure 1. In the center of each film a round circular hole was cut with a hardened-steel punch. It was hung between two checks (*2,3*). The upper check (*3*) is hung by a fishing line (*4*) over a pulley (*5*) from a winch (*6*). The winch is rigidly fastened to an axle (*7*), and pulleys (*5,10*). A cap (*11*) floating on mercury in a gutter (*12*) on top of the vessel (*17*) for the stress-cracking medium *17* is rigidly fastened to the axle (*7*). The axle (*7*) holds the winch (*9*) for the fishing line (*13*), which goes over the pulley (*10*), through the switch (*14*), and to the weight (*15*). The switch (*14*) is for the timer (*16*), which actuates as the sample (*1*) breaks. Stress-cracking tests with this apparatus were performed by suspending the film sample in the stress-cracking medium, a detergent (*17*) and by hanging a

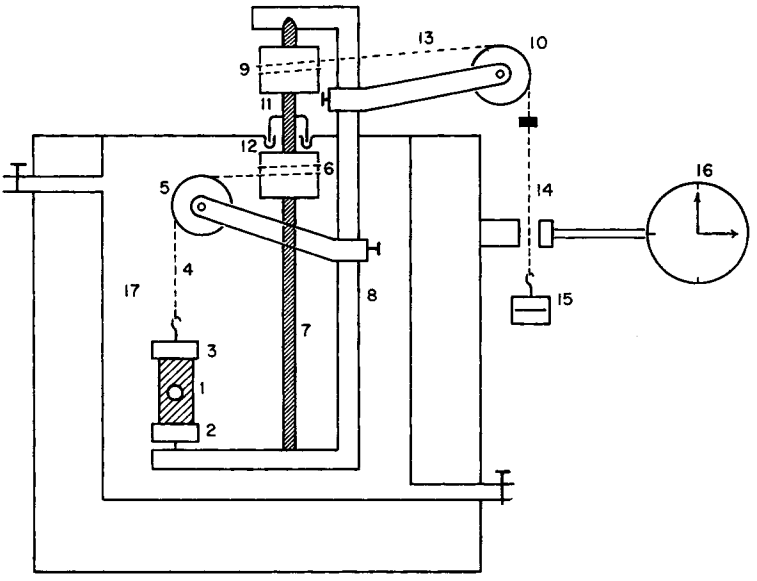

Fig. 1. Schematic diagram of environmental stress-cracking apparatus.

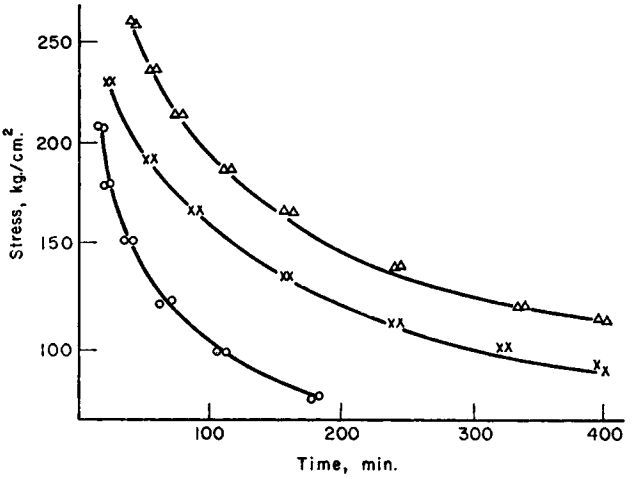

Fig. 2. Environmental stress-cracking curves: stress versus breaking time for three different types of polyethylene sample in detergent.

weight on the sample. The apparatus was so arranged that when the sample broke, the switch (*14*) actuating the timer (*16*) switched off.

Very smooth stress-cracking curves have been obtained with this apparatus.

References

1. I. L. Hopkins, W. O. Baker, and J. B. Howard, *J. Appl. Phys.*, **21**, 206 (1950).
2. H. R. Carey, *SPE J.*, **10**, 16, 41 (1954).
3. E. L. Lander, *SPE J.*, **16**, 1329 (1960).
4. P. Hittmair and Robert Ulman, *J. Appl. Polymer Sci.*, **6**, A1 (1962).

Mizuho Nisizawa

Department of Chemistry
Defense Academy
Yokosuka, Japan

Received October 31, 1967
Revised December 12, 1967