providing appropriate relaxation times are taken into account. In this connection, it is important to realize that the time constants measured in this work are related to a very restricted flow geometry and that relaxation times in a bulk material would be two or three orders-of-magnitude shorter than the time constants measured here. It should also be realized that if a high viscosity liquid is used as an environment, shear stress is produced in the liquid and in the sample during changes in pressure, but these shear stresses relieve in a characteristic time, and only after sufficient time are hydrostatic conditions established. The data reported here indicate what time scales are required when using a particular liquid, to keep shear levels below specified limit.

The analysis of the viscometer assumed a stress-independent coefficient of viscosity, and the fact that the semilog exponential decay curves were effectively straight lines implies that this is true even to the maximum pressures and viscosities studies. There was no indication of residual stress within the pressure sensitivity of approximately 1 bar, but no special effort was taken to establish the total absence of residual stress.

In this experiment, we report viscosity measurements from approximately 10^3 poise to 10^{10} poise covering an overall range of 10^7. It appears, however, that with some effort viscometers with S values differing by as much as 10^5 could be constructed, and since time constants from 0.1 sec to 10^4 sec can be measured, the over-all range could probably be extended to 10^{10} from 10 poise to 10^{11} poise. If pressure chambers were available with larger volumes, even lower viscosities could be measured. We have demonstrated the consistency of the technique with previous work at lower pressures and have effectively doubled the pressure range over which viscosity measurements have been made.

In light of the estimated uncertainties, the agreement of our measurements with Bridgman's isopropyl alcohol is better than could be expected but is satisfying and indicated the consistency of the two methods. We do not intend, however, to base the reliability of the technique on agreement with Bridgman's data since Bridgman stated that his data for isopropyl alcohol were taken in three sections using different viscometers and that an additive constant was applied to the higher viscosities to yield a smooth curve. Although the uncertainties indicated in Table I are not satisfying when compared to atmospheric measurements of viscosity, it should be noted that more precise viscosity measurements on an absolute basis are not justified practically until improved pressure calibration techniques and an improved experimental pressure scale are available. Furthermore, improved viscosity analysis would be meaningless until improved compressibility measurements are available on liquids in question. The experimental dependence of a viscosity measurement on compressibility of the liquid using this technique is somewhat inconsequential in a theoretical sense since any theoretical analysis of viscosity changes will be associated with volume changes rather than pressure, and thus reliable compressibility data would be required for any meaningful fundamental study independent of how the viscosities were measured.

ACKNOWLEDGMENTS

The authors wish to thank George E. Tomes for assistance in performing the experiments and Frank Becker who fabricated the capsules and viscometers for this work. We are particularly appreciative of the support and encouragement given by Dr. Horst H. Kedesdy, Director of Division E of the Institute for Exploratory Research.