haracter. Similar results were
ed with 0.05 M cerium(IV) re-
1×10^{-4} N HNO_3 and then
ld viscosities of WCS disper-
nt on rates of shear than those
Newtonian viscosity character
lyelectrolytes.
$PO_4^{=}$ in reducing viscosity of
Since hydroquinone reduces
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r, University of Massachusetts,

does not imply that they are
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RHEOLOGY OF POLYETHYLENE AT HIGH PRESSURES

Introduction

Recently interest has been expressed in the effect of mean stress on mechanical properties of polymers (1-5). For a great many materials, particularly the metals, yielding can be described quite accurately solely as a function of the shear stresses, e.g., the critical resolved shear, Tresca, and Von Mises criteria (6,7). Yielding in such materials does not depend on the hydrostatic component of the stress. Conversely, failure in some materials is known to be highly dependent on the mean component of stress. Information relating the dependence of mechanical properties on the hydrostatic component of applied stress should be useful in developing and understanding the mechanisms of plastic deformation and in the development of failure criteria.

Mechanical properties of most materials also shows some dependence on effects such as time and rate of loading and/or strain. These effects are perhaps most pronounced in polymers such as plastics and elastomers. These materials are generally classed as viscoelastic although most do not obey the formal mathematics of linear viscoelasticity (9). In studying the effect of pressure on the flow porperties of polymers, it appears, therefore, that it would also be helpful to investigate time effects.

A few years ago (1964-1965) the authors were interested in finding a material for use in seals suitable for long-term usage under high hydrostatic pressure. To obtain this information a study was undertaken of the flow properties of polymers at high pressure. From this information it was expected to be able to predict the useful life of seals. The material studied most thoroughly (and eventually used most extensively for seals) was polyethylene. With the recent upsurge in interest in pressure effects in polymers, it occurred to us that these results might be of more basic and general interest. Therefore, this letter was prepared.

Experimental Equipment and Techniques

The high-pressure equipment used is similar in all respects to that described elsewhere (10). It consisted of a thick-walled high pressure cylinder providing a working space 1 in. in diameter and approximately 5 to 6 in. in length depending on pressure. The pressure was developed and maintained by a press acting on a piston. The pressure media was technical grade kerosene.

Both relaxation and creep tests were conducted on the polyethylene. To measure the load, small cantilever load cells were constructed from tool steel and resistance strain gages. Output of the load cell was corrected for pressure effects that had previously been determined to be small (11,12). Displace-