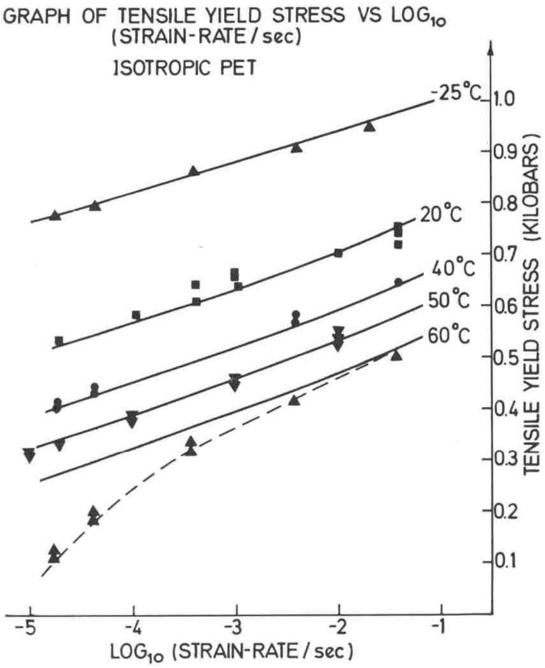


*Figure 2* The variation of the tensile yield stress of isotropic PET with temperature and strain-rate.

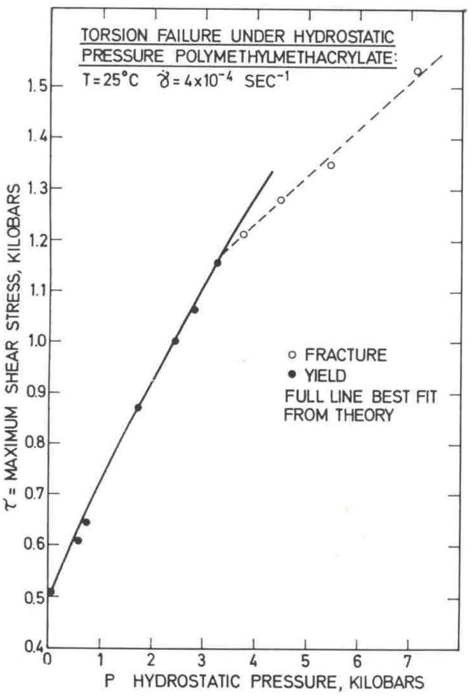


*Figure 3* The variation of torsional yield and fracture stress of PMMA with hydrostatic pressure (from [14]).

## 4. Discussion

The present results confirm, at least for PMMA, what is already well established, namely that the yield stress of an isotropic polymer depends on (*1*) temperature, (*2*) strain-rate and (*3*) hydrostatic pressure. It is believed, however, that they represent the first set of data to link these three aspects on the same material. Let us discuss first points (*1*) and (*2*) above.

The tensile and compressive yield stresses of poly(methylmethacrylate) and poly(ethylene terephthalate) are observed to increase with increasing strain-rate and with decreasing temperature. It should be noted that in general the plots of yield stress versus log (strain-rate) have a small but definite curvature, indicating that the theory of Eyring [15] in terms of a single simply activated flow process is not applicable to the present data. Our data differ from those of Bauwens-Crowet *et al* [16] and Holt [12] in this respect, but are in general agreement with the data of Roetling [18]. The theory to be described predicts a definite curvature in this type of plot which we therefore consider to be of greater generality than the linear behaviour.

Owing to the brittle nature of PMMA, in tension at room temperature, it was not possible to obtain direct comparison between tension and compression, but data from other work [1, 2, 14] clearly indicates that compressive yield stresses would be higher than tensile yield stresses. Further, the data from this paper shows the greater sensitivity of the compressive yield to strain-rate than the tensile yield.

It will be shown that the difference in behaviour between tension and compression can be attributed quantitatively to the dependence of yield on the hydrostatic component of stress. The theory is based on that of Robertson [13].

The tensile behaviour of PET also shows a slight curvature in the plots of stress versus log strain-rate. Additionally, at the higher temperatures, the stress was found to decrease more rapidly with decreasing strain-rate than at the lower temperatures. This was accompanied by the formation of tensile crazes before yielding at the high temperatures and low strain-rates, i.e. the normal shear mode of failure was preceded by craze formation.

## 5. Theory

A phenomenological theory of yielding has been developed from Robertson's theory [13] which uses the measured dependence of shear yield