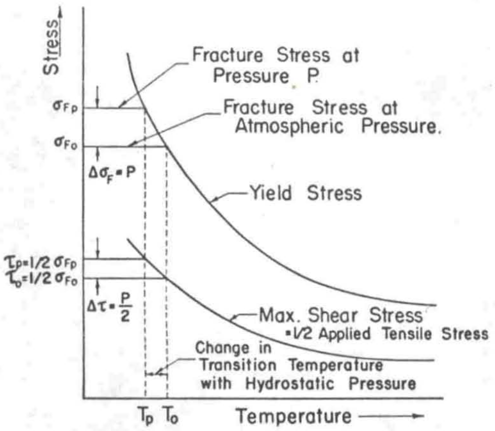

FIG. 4. Schematic representation of the fracture stress, yield stress, maximum shear stress, and the effect of applying a hydrostatic pressure.

applied hydrostatic pressure, and since it is then necessary to increase this maximum tensile stress by precisely this same amount before fracture will occur, it appears that fracture cannot occur until the maximum tensile stress achieves a critical value independent of the increase in shear stress which also occurs when the applied stress is increased. These ideas are illustrated graphically in Fig. 4.

The required fracture stress is independent of shear stress over the range studied. Thus if shear stresses play a role in the fracture process (for example by nucleating a crack which is subsequently controlled by tensile stresses) it must be that this occurs at or below the maximum shear stress present at atmospheric pressure (1/2 the atmospheric fracture stress at the transition temperature). The fracture stress measured for a variety of experiments dealing with the ductile–brittle transition of molybdenum appears to range between 75,000 psi and 120,000 psi with most of the values below 100,000 psi.[12,15,16] When the fracture stress is 75,000 psi (the value of Bechtold's "weakest" samples) the maximum shear stress is 37,500 psi and thus if a process involving shear is going to influence the fracture process it must be able to occur at or below a stress of this value and any process which requires more shear stress than this must be eliminated as a possible candidate for initiating fracture.

A further observation which can be made is that if the yield stress can be extrapolated as previously assumed (and the results of this experiment are *at least* consistent with an extrapolation of $\sim$20,000 psi) then it appears that if the initiation of fracture involves slip dislocations, these dislocations require a smaller stress to function than do the corresponding dislocations involved in the yield phenomenon because at a pressure P the critical shear stress for yield is an additional $P/2$ greater than the critical shear stress for initiating fracture (see Fig. 4). For $P =$ 20,000 psi this increase is 10,000 psi or 26.6% of the 37,500 psi stress discussed above. Since fracture can conceivably be initiated by twinning at a stress below that required for slip as Sleeswyk[17] discusses, it would seem that twinning is a likely candidate for the initiation of fracture. These results would appear to require generation and propagation of microtwins to take place below about 37,500 psi if they are responsible for fracture nucleation. However, the growth of the fracture appears to be the rate limiting process since fracture cannot occur until a critical tensile stress is reached.

ACKNOWLEDGMENTS

The authors would like to thank Dr. K. L. DeVries for help with the pressure equipment and Mr. Robert Monroe for technical assistance. We also wish to acknowledge the financial support given by the U.S. Air Force Office of Scientific Research.

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