surized, were carried out on a Hedeby universal tester at strain rates of about 10^{-5}, 10^{-4}, 5×10^{-4}, 10^{-3}, 2×10^{-3}, 5×10^{-3} and 10^{-2} sec^{-1}. Temperatures, other than ambient, were obtained by surrounding the specimen with a heated vegetable or silicone oil, maintained at a temperature constant to within ± 1°K during a test.

For all strain rates the increase in yield stress and the decrease in ductility with decreasing test temperature characteristic of the b.c.c. transition metals were observed. Yield points were exhibited by only 17 of the 30 "definitely ductile" specimens of both batches and for the ductile specimens not showing a yield point the stress at the apparent proportional limit was taken to be the yield stress. For tests carried out at, especially, the lower strain rates difficulty was experienced in deciding from the autographic charts whether a specimen was "just ductile" or brittle. There were 28 "definitely brittle" specimens and 19 in the former category. As we have defined T_T as the lowest temperature at which macroscopic plastic deformation is detectable, our values of T_T, shown plotted as a function of $\dot{\varepsilon}$ in Fig. 1, are the upper limits of the transition temperatures. The values of the transition stress were 53, 57, 55, 55, 54, 61 and 57 kg mm^{-2} at strain rates of 10^{-5}, 10^{-4}, 5×10^{-4}, 10^{-3}, 2×10^{-3}, 5×10^{-3} and 10^{-2} sec^{-1} respectively, *i.e.* 57 ± 4 kg mm^{-2}.

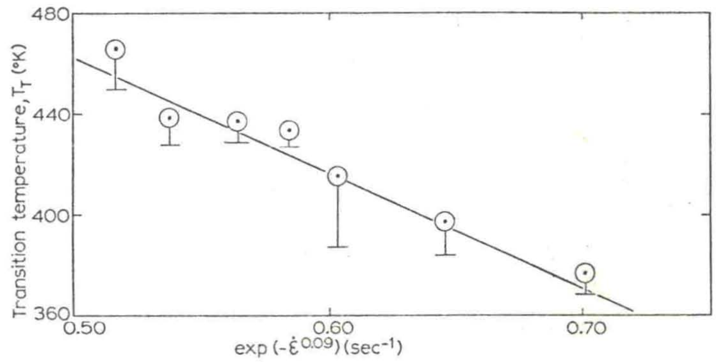

Fig. 1. The dependence of the ductile–brittle transition temperature, T_T, on strain rate, $\dot{\varepsilon}$, in recrystallized sintered tungsten of mean grain diameter 50 μ.

The pressurization treatment failed to produce detectable irreversible changes in either the yield stress or the transition temperature at the 5 strain rates and accordingly it is concluded that 14 kbars is insufficient to alter irreversibly the mechanical properties of our sintered polycrystalline Sylvania tungsten. Hereafter no distinction will therefore be drawn between pressurized and unpressurized specimens. Tests on cast[6] specimens pressurized at ~30 kbars and on sintered (American) General Electric specimens[7] pressurized at 25 kbars also failed to reveal any effect.

Metallographic examination revealed non-propagating cracks, away from the fracture surfaces, only in ductile specimens. These microcracks appeared to be located mainly in the surface layer, ~100 μ deep, and were predominantly intergranular in character (Fig. 2). The size of these cracks ranged from ~20 μ to ~150 μ, *i.e.* several grain diameters.

In this polycrystalline sintered tungsten the transition from ductile to brittle behaviour appears to occur at a constant stress of 57 ± 4 kg mm^{-2} for strain rates from 10^{-5} to 10^{-2} sec^{-1} as the transition temperature is raised from ~377° to ~465°K.