

FIG. 3. Creep curves for lithium at 77°K, various σ_0 :
 1—0.1; 2—0.2; 3—0.3; 4—0.6; 5—1.2; 6—1.3; 7—1.5 kg/mm²

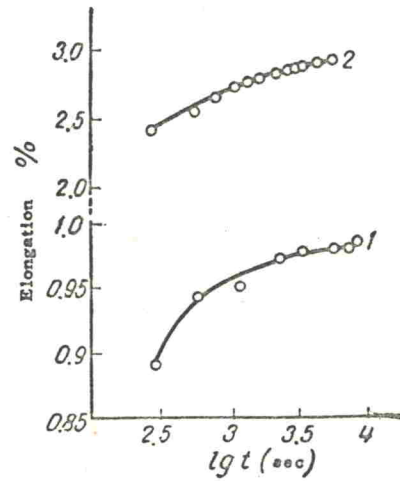


FIG. 4. Creep curves of lithium at various temps and stresses.
 1— $\sigma_0 = 0.1$ kg/mm² $T = 300^\circ$ K; 2— $\sigma_0 = 1.0$ kg/mm² $T = 180^\circ$ K.

depend on the stress magnitude above σ_0 .

Fig. 3 shows the results of the creep of lithium at 77°K in semilogarithmic coordinates: relative deformation-log time at different stress levels. It can be seen that low-temperature creep definitely follows the logarithmic law at stresses right up to 0.3 kg/mm². At 0.6 kg/mm² and above the logarithmic dependence is not satisfied.

As expected, at 180°, and more particularly at 300°K (i.e. at quite high temperatures) despite the stable crystalline structure of the metal, creep in lithium does not follow the logarithmic law (Fig. 4). But comparing Figs. 3 and 4 it can be seen that as the temperature falls the deviation from the logarithmic law diminishes, even at quite considerable stresses.

The kind of interdependence observed between the parameters and creep curves in the case of annealed lithium can be explained as follows. The low-temperature creep of lithium at stresses below the yield point (0.5-0.6 kg/mm²) occurs at the stages of instantaneous deformation and transitory yield by movement of dislocations, their exhaustion in the original lithium lattice and accumulation at various different barriers. In this case the time dependence of creep is very well described by the logarithmic law ($\epsilon = a \lg t + c$). If the stress is increased to levels above the yield point at 77°K creep will occur, accompanied by the polymorphous transformation from the b.c.c. to h.c.p. lattice*. At this stress level there is also a big increase in the instantaneous deformation and transitory yield.

As follows from the electrical resistivity data (see Fig. 7) the rise in instantaneous deformation during creep cannot be due to an increase in stress alone, but mainly to an increase in the mobility of the lattice as a result of the strain transition which is taking place. But the reduction in the deformation at the transitory stage as compared with that described by the logarithmic law must be ascribed to a drop in the mobility of dislocations due to the partial polymorphous transition. Thus, while the deviation from the logarithmic law for the transitory stage of creep in specimens tested at 300 and 180°K is due to the relatively high testing

* To a certain extent the transition from b.c.c. to h.c.p. is also possible, since this follows from measurements of damping capacity at low temperatures [12].