shown here) to a yield point not seen in the "as-received" crystals. The broad region of approximately zero work hardening is associated with the expansion of glide bands into undeformed portions of the crystal. When the glide bands fill the crystal, a positive rate of work hardening obtains. It is apparent that the effect of pressure on the flow stress is uninfluenced by whether glide bands do or do not fill the crystal. There is no apparent effect of pressure on the rate of work hardening in either soft, "as-received" crystals or irradiation-hardened crystals (Table I).

The experiment shown in Fig. 4 differs from the ideal of Fig. 2 in that several load cycles are used at each test pressure. This is done so that errors due to "zero-shift" in the load cell (which occur occasionally) will be detected. Repeated loading sometimes leads to the occurrence (for all of the crystals studied except LiF) of small yield drops in the σ–ϵ curve; in successive loading cycles the stress rises slightly higher than the previous maximum stress, before it drops and levels off to the same steady rate of work hardening on a curve extrapolating through the previous work hardening curve. Cycles 5 and 6 in Fig. 5 for soft KI show the most pronounced case of this phenomenon observed; cycles 8 and 9 show a modest, more typical stress increment. This sort of small yield drop has been observed by Haasen and Kelly[8] during interrupted tensile tests on single crystals of pure Ni and Al. They propose that the effect is related to dislocation rearrangements during unloading, rather than to an aging process. For the purposes of extrapolating to the fiducial strain, the steps in the σ_s–ϵ_p curve are ignored.

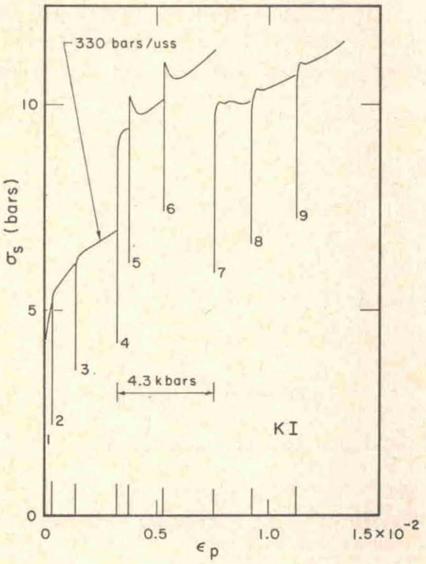

FIG. 5. Shear stress vs shear strain for single-crystal KI (No. 2). The rate of work hardening at 1 atm prior to pressurization is noted.

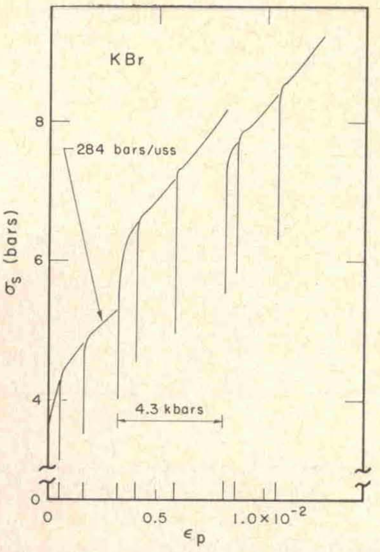

FIG. 6. Shear stress vs shear strain for single-crystal KBr (No. 4A).

In contrast with LiF, KI and KBr show a large increase in flow stress and an increase in work-hardening rate, respectively, under pressure, (Figs. 5 and 6). In both soft (Fig. 7) and irradiated KCl (Fig. 8) a pressure-induced increase in σ_s and $d\sigma/d\epsilon$ is evident. Alden[9] has indicated that KCl can show two stages of work hardening with a typical slope in stage I of 180 bar and in stage II of 540 bar. The soft KCl crystals tested deform with only stage-II hardening but KCl crystals

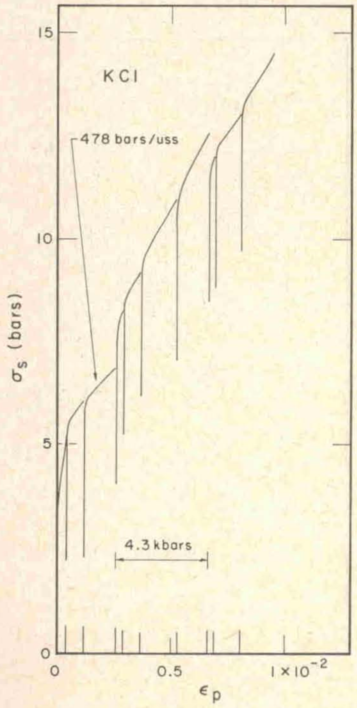

FIG. 7. Shear stress vs shear strain for soft KCl (No. 20).

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[8] P. Haasen and A. Kelly, Acta Met. **5**, 192 (1957).

[9] T. H. Alden, Trans. Met. Soc. AIME **230**, 649 (1964).

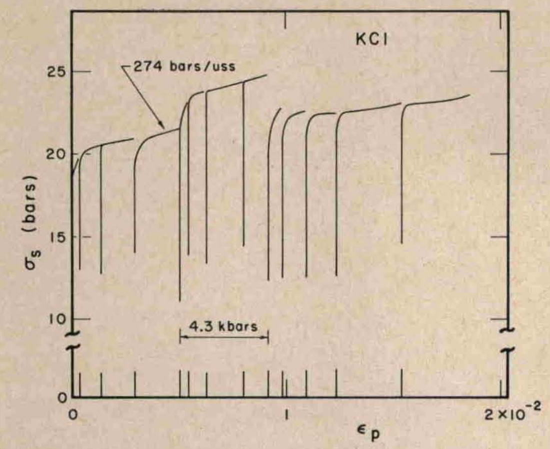

FIG. 8. Shear stress vs shear strain for hard KCl (No. 14A); $d\sigma/d\epsilon$ is less than for soft KCl.

hardened by irradiation exhibit a rate of work hardening more nearly like that of stage I. Another feature observed in Fig. 8 is the occurrance of a region of low work hardening when a crystal is loaded at $P=1$ atm after having been loaded at pressure. This phenomenon occurs on occassion for all the materials tested except LiF and CsBr. It is apparently a work-softening effect analogous to that observed by Stokes and Cottrell[10] for a metal deformed at low temperature and then redeformed at a considerably higher temperature. Stokes and Cottrell found in their experiments that the effect does not arise from the pinning of dislocations by point defects or impurity atoms. They suggest that the dislocation arrangement introduced by low-temperature deformation becomes unstable when deformation at higher temperature is initiated. In the present case the Gilman and Johnston[11] theory of the occurrence of yield points in the alkali halides suggests that the observed pressure-induced work softening may be related to a reduced rate of generation of mobile dislocations in the crystal during plastic deformation at pressure. If the deformation of a crystal from ϵ_a to ϵ_b at high pressure generates fewer dislocations than would be generated between ϵ_a and ϵ_b by deformation at $P=1$ atm, the occurrence of a yield drop on reinitiation of plastic deformation at ϵ_b and $P=1$ atm could be expected due to a deficiency in the number of mobile dislocations. A decreased generation rate could occur, for example, if pressure inhibited the occurrence of cross slip. The pressure-induced increase in the work-hardening rate (observed in all the alkali studied except LiF) may be associated with a slower rate of generation of mobile dislocations. When extrapolating the "pressure release" σ_s–ϵ_p curve to the fiducial strain it is found that results for $\delta\sigma/\sigma$ consistent with those which occur on pressure application are obtained when the "work-softening" upper yield point is not taken as the flow stress, i.e., the σ–ϵ curve is extrapolated below this "yield point."

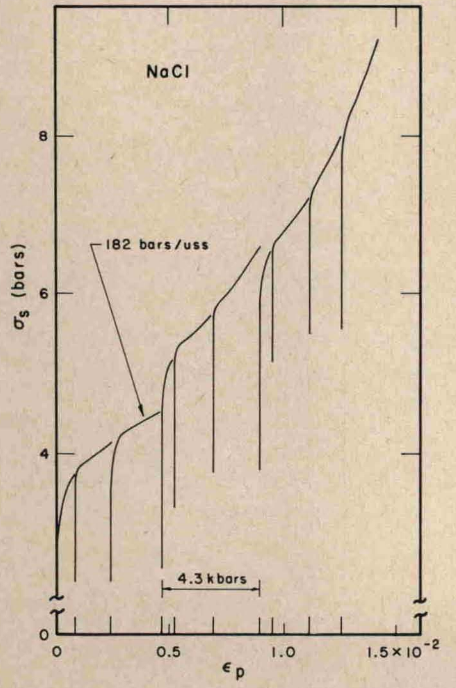

FIG. 9. Shear stress vs shear strain for soft NaCl (No. 27).

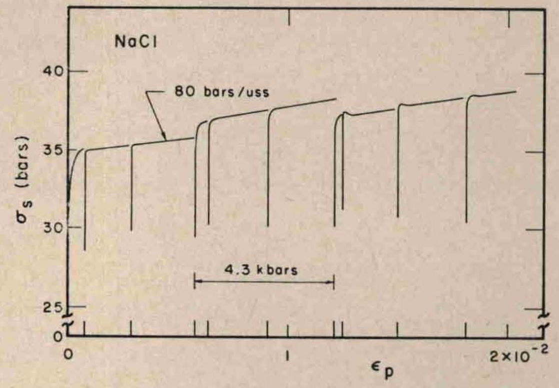

FIG. 10. Shear stress vs shear strain for hard NaCl (No. 26B); $d\sigma/d\epsilon$ is less than for soft NaCl.

Figures 9 and 10 give σ_s–ϵ_p curves for soft and irradiation hardened NaCl, respectively. The soft NaCl sample of Fig. 9 displays a pressure-induced increase of σ_s and $d\sigma/d\epsilon$. In the case of unirradiated crystals there is an occasional tendency for NaCl to show a sudden increase in work-hardening rate, i.e., to enter stage II, under pressure. Comparison of σ–ϵ curves for samples deformed at $P=0$ with those for other samples deformed at 4.3 kbar indicates a general tendency for stage I to be shorter at high pressure. Alden found that the rate of stage-I hardening in NaCl is 100–150 bar and the rate of stage II is 400–750 bar. The soft crystals

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[10] R. J. Stokes and A. H. Cottrell, Acta Met. **2**, 343 (1954).

[11] J. J. Gilman and W. G. Johnston, in *Solid State Physics*, F. Seitz and D. Turnbull, Eds. (Academic Press Inc., New York, 1962), Vol. 13, p. 147.