Table I. Cyclotron resonance masses for H_0 parallel to [111].

Experimental	Theoretical[a] Value	Orbit
0.222 ±0.006	0.23	Type B arms in 3rd zone
0.255 ±0.005	0.29	Type A arms in 3rd zone
0.79 ±0.04		
0.88 ±0.04		
0.94 ±0.04	0.94	$k_H \sim 0$ orbits in 2nd zone
1.3 ±0.1		

[a]From the free-electron model.

distorted, and the arms in the third zone will fall into two types: those with their axes along ⟨110⟩ directions, and the rest with their axes along ⟨101⟩ directions. These two will henceforth be referred to as type A and type B arms, respectively.

The theoretical effective masses shown in Table I were obtained graphically by the method described by Harrison.[4] The mass of 0.29 arises from elongated orbits on type A arms, and 0.23 from similar orbits on type B arms. The kind of distortion of these arms that has been suggested, in the case of aluminum,[5] would, when applied to indium, increase the number of electrons contributing to the above two masses. It may be pointed out here that Shoenberg[6] obtained a mass of 0.30 from de Haas-van Alphen measurements with the magnetic field along the [110] direction. The mass of 0.94 arises from orbits in the second zone which have a vanishing or very small component of momentum in the field direction.

The study is being extended to samples of other orientations and to higher frequencies. Helpful discussions with D. W. Feldman are gratefully acknowledged.

[1]B. S. Chandrasekhar, Rev. Sci. Instr. (to be published).

[2]J. G. Castle, Jr., P. F. Chester, and P. W. Wagner, Phys. Rev. 119, 953 (1960).

[3]W. A. Harrison, Phys. Rev. 118, 1182 (1960).

[4]W. A. Harrison, Phys. Rev. 118, 1190 (1960).

[5]W. A. Harrison, Phys. Rev. 116, 555 (1959).

[6]D. Shoenberg, Phil. Trans. Roy. Soc. (London) A245, 1 (1952).

INFLUENCE OF DISLOCATION ON DIFFUSION RATE OF F CENTERS IN KCl

Hiroyuki Mizuno and Shigeko Miyamoto
Matsushita Electronics Corporation, Takatsuki, Osaka, Japan
(Received March 27, 1961)

In a previous paper[1] it was suggested that at temperatures below 500°C the diffusion of F centers in a KCl crystal might take place predominantly along disordered interfaces. In the present report an experimental confirmation of this "diffusion along disordered interfaces" will be given.

The basic idea underlying our method of establishing such a predominance and estimating its rate is the following. If in a crystal an abnormally high density of dislocations along a definite orientation is created, e.g., by microscopic deformation, then the crystal should show a distinct anisotropy of F-center diffusion after additive coloring.

In the experiments KCl was purified by crystallizing it twice by the Kyropoulos method. From the single crystal thus obtained rectangular blocks were cut of $1.0 \times 1.5 \times 2.0$ cm^3. These blocks were deformed in an elastic clamp. After 60 minutes exposure to the pressure the rate of compression along [100] was 7.3%. The deformation of the crystals resulted in only a single pair of mutually perpendicular slip systems as indicated in Fig. 1.

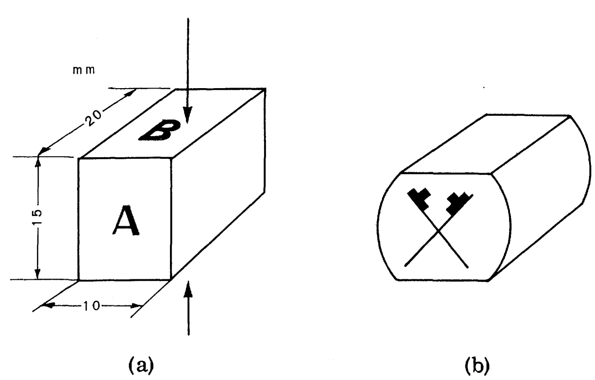

FIG. 1. A crystal employed for the experiment. (a) Before compression. (b) After 7.3% compression, dislocations belonging to one single slip system only are present.

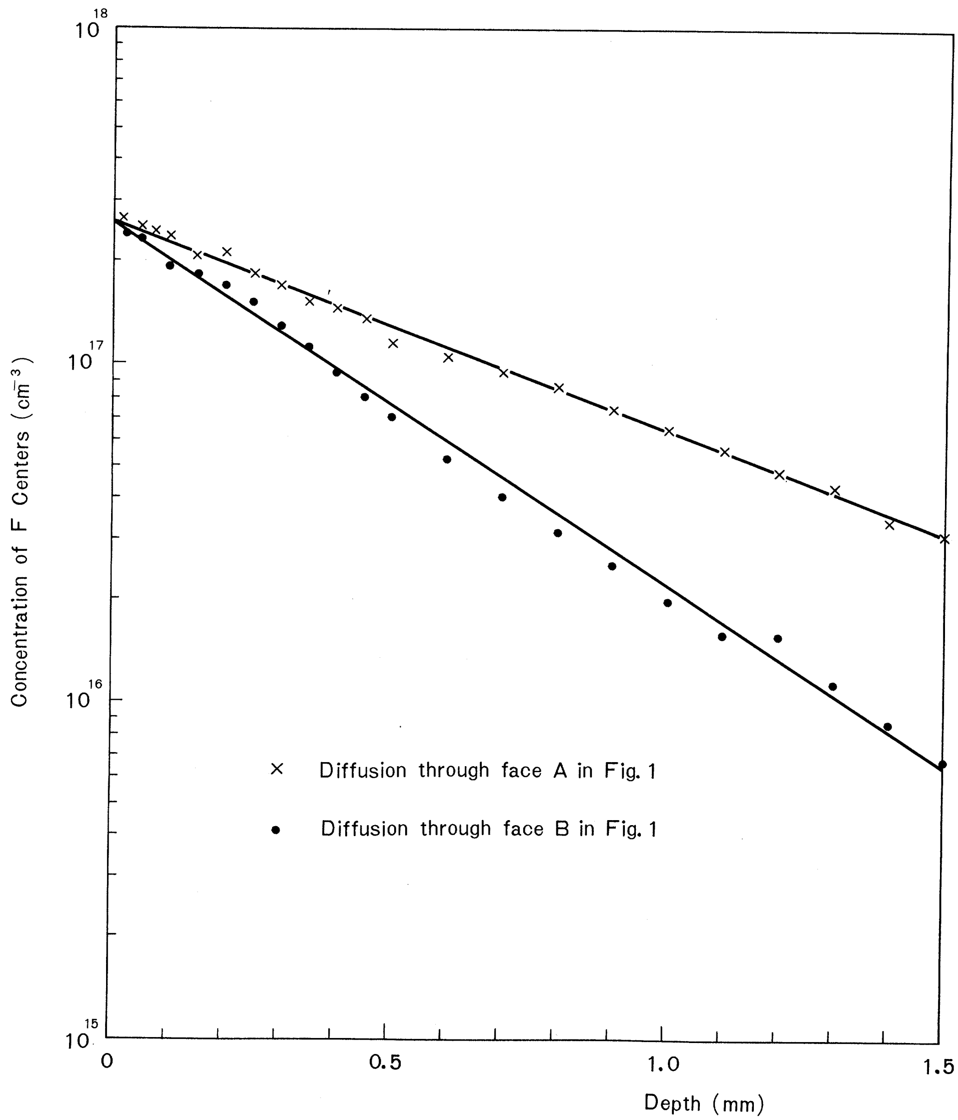

FIG. 2. Penetration curves of F centers in KCl through different lateral faces.

The deformed crystal was colored by heating it to 450°C in potassium vapor. A heating time of 20 hours was found to be sufficient for obtaining colored crystals which showed a marked concentration gradient of F centers. The concentrations in different regions of the crystal were measured optically, using a thin beam of monochromatic light.

The measurements were carried out in the center of each exposed face in order to avoid interferences from F centers which had penetrated through the other faces. The results are shown in Fig. 2. It appears that the rate of F-center diffusion through face A, that is along the orientation of produced dislocations, is nearly three times as fast as that through face B. It seems reasonable to conclude that this anisotropy is due to the pronounced orientation of the crystal dislocations. Assuming a dislocation density of 10^9 cm^{-2} for 7.3% deformation, a dislocation width of 10^{-7} cm, and a volume diffusion coefficient of F centers of 3.9×10^{-9} cm^2 sec^{-1} at 450°C,[1] a diffusion coefficient along a disordered interface (dislocation) can be derived according to Fisher's formula.[2] This is found to be 3.7×10^{-8} cm^2 sec^{-1} at 450°C.

The authors wish to express their sincere thanks to Professor H. Kawamura for suggesting the experiment.

[1]H. Mizuno and M. Inoue, Phys. Rev. 120, 1226 (1960).

[2]J. C. Fisher, J. Appl. Phys. 22, 74 (1951).