ture for Ni in 30-25-45 Perminvar which has been suitably annealed has a pronounced difference. At about 65 ev above the absorption edge there is an extra maximum which is comparable in magnitude with any of the principal maxima in the structure. No indication of the new, anomalous peak has ever been observed in the Fe and Co edges of Perminvar nor has it yet been seen in the Ni edge of the Permalloys. The occurrence of the anomalous absorption peak at about 65 ev is directly connected with a particular state of aggregation of oxygen in the alloy. Curves *a*, *b*, and *c* of Fig. 2 show a region of the extended fine structure where the anomalous peak is deliberately and controllably introduced through heat treatment in wet hydrogen. Curve *a* is for vacuum-annealed Perminvar and is typical of f.c.c. nickel. Curve *b* results from 2 hr at 800°C in wet hydrogen with a water quench. Curve *c* shows the anomalous peak after additional annealing at 600-400°C. The temperature range where the new peak is strongly developed is identical with the temperature range for magnetic annealing.

Transmission electron diffraction results for the three states illustrated in Fig. 2 all exhibit a precipitated metal monoxide. It must be concluded that precipitated oxides are not the cause of the anomalous peak but rather that an earlier state of segregation is responsible. The present indications are that the "oxygen faults" described in reference 2 are the cause of the anomalous absorption in the Ni edge as well as the magnetic annealing properties.

The authors are indebted to E. A. Nesbitt for aid in the preparation of alloys and their heat treatments.

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INVERSION SYMMETRY OF THE *M* CENTER

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According to the model proposed by Seitz,[1] *M* centers in alkali halide crystals consist of two negative-ion vacancies, one positive-ion vacancy, and an electron, as shown schematically in Fig. 1 (a). The low symmetry (C_{2v}) of this model has made the *M* center a particularly interesting subject for theoretical[2] and experimental[3-6] study. The purpose of the present note is to suggest a slight modification of the model which has all the essentials of the original but which, in addition, exhibits inversion symmetry.

Consider the ionic configuration of Fig. 1 (a) with the electron removed. If the three vacancies remain associated, the positive ion marked *M* will trade places with the positive-ion vacancy at a certain jump frequency determined in part by the nature of the potential barrier separating these two equivalent positions. When *M* is in the region midway between these two positions, it experiences practically no repulsive force from the ions in the plane of the center, and the elec-

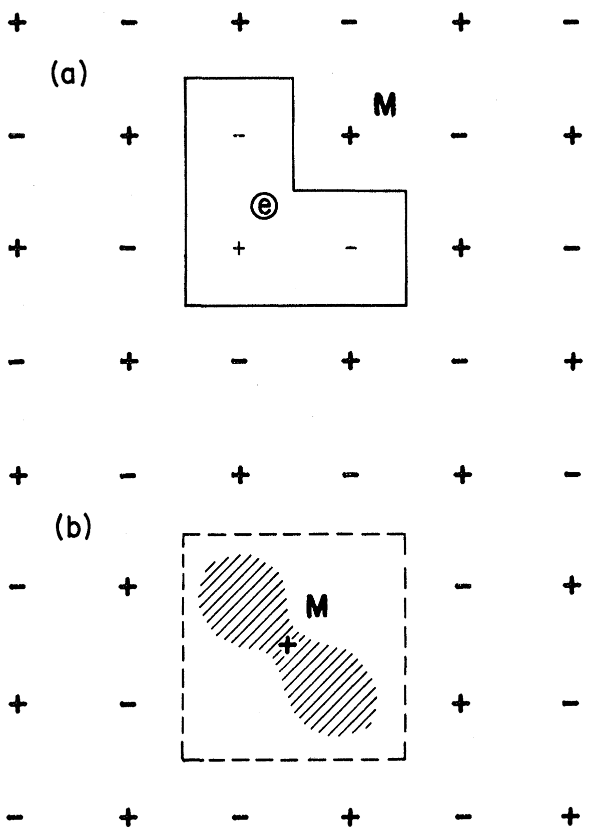

FIG. 1. Models of the *M* center in alkali halide crystals. (a) The original Seitz model, (b) a proposed revision of its configuration. In (a) the boxes represent vacancies and *e* represents an electron. In (b) the region outlined by a dashed line is occupied only by the ion *M* and the electron, whose possible distribution is indicated by the shaded region.

trostatic potential has a saddle point at the midpoint. With the electron present, it is reasonable to assume that the jumping still takes place but that the electron, in trying to adjust adiabatically to the configuration of the center, associates itself as closely as possible with the positive ion. The effect of the electrostatic saddle point is thus at least partially washed out and the ion may spend more of its time in the central position, as sketched in Fig. 1 (b). Once this configuration is established the electron will be drawn toward the positively charged corners of the "pillbox" in which it now finds itself. Thus the electronic, as well as configurational, symmetry of the center is changed from C_{2v} to D_{2h}. One may consider the central ion-electron pair as simply an alkali atom, distorted toward the nearest neighboring positive ions.

Overhauser and Rüchhardt[5] tentatively conclude that centers responsible for the M absorption band have inversion symmetry on the basis of the absence of a large differential Stark effect as measured by line broadening at high external electric fields. Centers whose configurations are that of Fig. 1 (a) have permanent dipole moments and such a Stark effect is likely, according to these authors' computations. Jacobs[6] was unable to find dielectric loss which could be associated with jumping of the M-center positive ion across a sizeable potential barrier. The model of Fig. 1 (b) is suggested in an attempt to reconcile these negative results with the original model, which is a plausible result of coagulation of F centers and neutral vacancy pairs.[1] Since the basic composition and the predominantly (110) symmetry of the center have been left unchanged, no reappraisals of experiments on formation and optical bleaching of the center[1-3] are necessary, while the lack of a sizable potential barrier and the presence of inversion symmetry seem to be complementary to each other on the revised model.

Detailed computations are necessary to establish the quantitative plausibility of the inversion symmetry model, but spin resonance experiments will probably be of more immediate assistance in its evaluation. A resonance associated with M centers has already been identified,[4] but this resonance is hardly resolved from that of F centers and double resonance measurements[7] (presently in progress at the University of Illinois[8]) are necessary to obtain more definite information on the center's structure.

The author is indebted to Dr. G. Jacobs for interesting discussions of his experiments and to Professor F. Seitz for his kind interest in this work.

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SPIN-LATTICE RELAXATION FROM STATE OF NEGATIVE SUSCEPTIBILITY*

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A state of negative magnetic susceptibility has been demonstrated in potassium chromicyanide by using a 180° pulse technique. The spin-lattice relaxation from this state has been observed in the time domain, and the complex susceptibility shows no change in slope as it passes through zero.[1]

Negative paramagnetic susceptibility has been demonstrated in nuclear magnetic resonance with the use of both rapid passage[2] and 180° pulse techniques.[3] Negative electron paramagnetic susceptibility has been produced in the three-level maser[4] and in the two-level maser by means of rapid passage.[5,6] The feasibility of generating a negative susceptibility in semiconductors by using spin-echo techniques has also been demonstrated.[7] We have produced negative electron magnetic resonance susceptibility by means of a 180° pulse. The working material was $K_3Co(CN)_6$ containing 0.1% Cr^{3+}. The $-\frac{1}{2}\rightarrow+\frac{1}{2}$ transition at 9000 Mc/sec in a field of 3150 gauss, oriented parallel to the crystalline c-axis, was used.