shown. These are plotted against the applied field and the corresponding values of internal field as determined from an experimental $B-H$ curve are shown on the auxiliary scale. The extra absorption peaks are repeatable and are being investigated in detail.

By placing the disk at the center of the cavity at the electric field maximum we obtain the real and imaginary dielectric constant of the same sample.

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[1] J. O. Artman and P. E. Tannenwald, Phys. Rev. **91**, 1014 (1953).
[2] C. Kittell, Phys. Rev. **73**, 155 (1948).
[3] D. Polder, Phil. Mag. **40**, 99 (1949).

Hollow Dislocations and Etch Pits

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SOME time ago Frank[1] showed that dislocations having large Burgers vectors should be hollow. The present letter considers the conditions necessary to open up any dislocation (forming an etch pit) by placing the crystal in an undersaturated medium. The idea is simply to generalize Frank's analysis (limited to equilibrium conditions) to the general case of growth or evaporation. Let us consider a crystal containing a hollow dislocation of radius r and Burgers vector b. The crystal is *not* in equilibrium with the surrounding medium, and the decrease in free energy of the system by the formation of a unit volume of crystal (supposed perfect) is ΔG_v. If $\Delta G_v>0$, the crystal is growing; if $\Delta G_v<0$, the crystal is evaporating.

Then an increase by dr of the radius of the hollow will produce a change dG in the free energy of the system, per unit length of dislocation, equal to

$$dG=\Delta G_v 2\pi r dr+\gamma 2\pi dr-(\mu b^2/8\pi^2 r^2)2\pi r dr,$$

where γ is the crystal-medium surface energy, and μ the shear modulus. The value of r satisfying the condition $dG/dr=0$ will correspond to a steady state situation where the radius of the hollow remains constant, while the crystal grows or evaporates. This value of r is given by

$$r=\tfrac{1}{2}\rho_c\{[1+4(r_0/\rho_c)]^{\frac{1}{2}}-1\},$$

where $\rho_c=\gamma/\Delta G_v$ is the critical radius for two-dimensional nucleation on the surface of the crystal and $r_0=\mu b^2/8\pi^2\gamma$ is the radius of the hollow when the crystal is in equilibrium with the surroundings.

If $\rho_c>0$ ($\Delta G_v>0$), the hollow tends to close up as ρ_c decreases (ΔG_v increases). If $\rho_c<0$ ($\Delta G_v<0$), the hollow tends to open up giving a steady-state solution as long as $|\rho_c|$ is larger than the critical value $|\rho_c'|$ given by

$$\rho_c'=-4r_0.$$

For larger undersaturations the surface energy is not large enough to keep a constant radius for the hollow, and the etch pit is formed. If the surrounding medium is either vapor or dilute solution, $\Delta G_v=(kT/\Omega)\ln(p/p_0)$, where Ω is the molecular volume and p_0 the saturated pressure or concentration; the critical undersaturation ratio p_0/p_c is then given by

$$\ln(p_0/p_c)=2\pi^2\gamma^2\Omega/kT\mu b^2. \quad (1)$$

There is qualitative evidence for the critical opening up of a dislocation in the dissolution of CdI_2 crystals where the Burgers vectors are quite large (for instance, in the General Electric motion picture film). More quantitative experiments to test formula (1) would be worthwhile. Concerning the formation of etch pits in dislocations of small Burgers vectors, it is clear that this is only possible in a medium in which γ is considerably below the value corresponding to the free surface of a crystal.

[1] F. C. Frank, Acta Cryst. 4, 497 (1951).

Ferromagnetic Resonance in Iron-Nickel Alloys*

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AN anomalous sharp dip in the g value of iron-nickel alloys in the range of 30 to 50 percent nickel in colloidal suspensions has been reported by Bagguley,[1] the g value for 40 percent nickel falling to 2.01. Ferromagnetic resonance experiments have been made on disk-shaped bulk samples in an effort to verify this variation in g value with changing nickel concentration. Wavelengths of 6 mm, 1.2 cm, and 3 cm were used. Little or no variation in g value was observed in the four samples of varying nickel concentration investigated.

Disks 0.450 in. in diameter and about 0.010 in. thick, prepared from cold-rolled strip recrystallized at 1080°C for four hours, were polished with jewelers rouge, annealed in vacuum for two hours at 800°C, cooled slowly, and electropolished in a hot phosphoric acid-chromic acid solution. A small hole was drilled in the wall of a rectangular microwave cavity and the samples were clamped firmly to this wall. The 3-cm and 1.2-cm experiments were made using a reflection-type cavity forming one arm of a magic-T bridge. In the 6-mm experiments a crystal harmonic generator driven by a $2K33$, K-band klystron was used as a