The course of sintering predicted by these expressions is in qualitative accord with experimental results on the sintering of uniform spherical copper particles regularly packed and sintered both in argon at one atmosphere and in vacuum. If, however, we accept Samoilovich's[3] value of about 1200 dynes per centimeter for the surface tension of solid copper, then the experimental results indicate a much higher value for the viscosity coefficient than is predicted by Frenkel from the values of the self-diffusion constant reported in the literature.[4]

The viscosity coefficients calculated from the experiments are 2.4×10^{10} second per cubic centimeter at 850°C and 5×10^{9} second per cubic centimeter at 900°C, corresponding to a value for the heat of activation of self-diffusion of copper of over 85,000 calories instead of the 57,000–61,000 calories reported by Barrier.[4]

Further experiments are under way to see whether other metals exhibit the same phenomenon and to determine whether the discrepancy lies in the value of the surface tension, that of the self-diffusion constant, or in the mechanism of flow as analyzed by Frenkel.

If the process of sintering is as described above, it can be concluded that in the absence of entrapped gas, when the pores are of a range of sizes, the small pores disappear first and successively larger pores shrink at a later time, or at a higher temperature if the time of sintering is held constant. Ideally all pores eventually disappear at any temperature. In the practical case gas is always entrapped during the compression used to form powder metallurgy products. At first the smallest pores shrink, yet pores larger than a maximum size later expand rather than contract. In accordance with this analysis gas-containing aggregates were made to shrink, and, by varying the external pressure, were subsequently expanded.

[1] J. Frenkel, J. Phys. U.S.S.R. **9**, 392 (1945).
[2] J. J. Kanter, Metals Technology **4**, 8 (1937).
[3] A. Samoilovich, Acta Physicochimica U.R.S.S. **20**, 97 (1945).
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Ferromagnetic Resonance at Microwave Frequencies

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GRIFFITHS[1] has recently described a new resonance phenomenon in ferromagnetic materials, caused by the interaction of processing electrons with a magnetic field at microwave frequencies. Kittel[2] has shown that the resonance frequency is in close agreement with the Larmor frequency calculated for the fictitious field $(BH)^{\frac{1}{2}}$ and has given an expression for the complex permeability in the direction of the r-f magnetic field from which the apparent permeability, μ_r, can be derived. In this note we report experiments designed to test Kittel's theory and to evaluate the gyromagnetic ratio.

Experimental conditions have been chosen in accordance with the simplifying assumptions of the theory. The magnetic material used, Supermalloy,[3] has a very low magnetic crystal anisotropy and is probably the most easily saturable material known. By using thin foils and extending them beyond the walls of the cavity, the demagnetization factor in the direction of the static field is reduced to an estimated value of 30 oersteds when the material is magnetized to saturation ($B_s=7900$). A section of rectangular wave guide was terminated by a metal plate and a resonant cavity formed by the introduction of an asymmetrical inductive window of high susceptance one wave-length away from the end plate. The narrow sides of the cavity were milled off, and thin foils (0.004 in. thick)

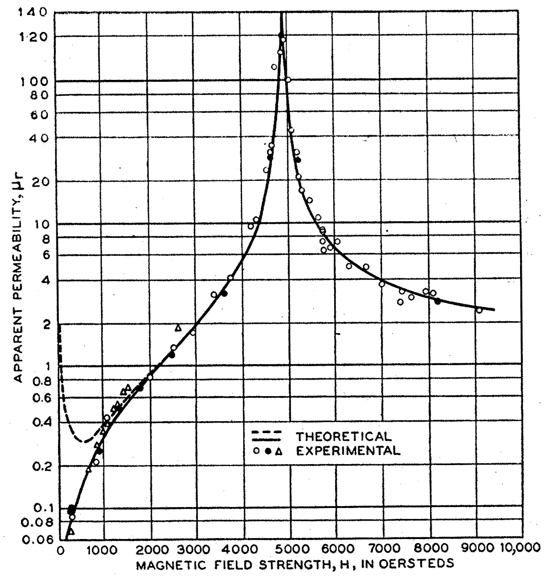

FIG. 1. Resonance curve on semi-log scale, showing points taken in different runs and theoretical curves for two kinds of assumed damping.

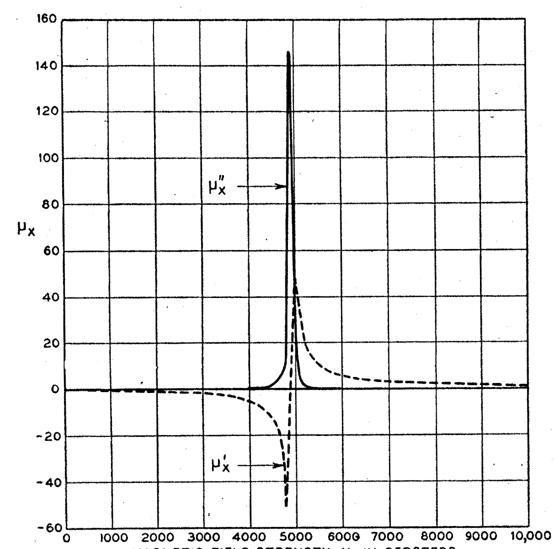

FIG. 2. Real (μ') and imaginary (μ'') components of complex permeability, plotted on linear scale.

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