Abstracts of Technical Articles from Bell System Sources

Electricity in Gases.[1] KARL K. DARROW. The material in this paper was presented as the Joseph W. Richards Memorial Lecture delivered before the Electrochemical Society at Cincinnati, April 23, 1936. This lecture presents in a vividly descriptive manner some of the material published in past issues of the *Bell System Technical Journal.*

Electron Diffraction Experiments Upon Crystals of Galena.[2] L. H. GERMER. Cleaved surfaces of galena crystals yield electron diffraction patterns made up of Kikuchi lines, and spots which are drawn out into streaks by refraction. After etching, the spot pattern predominates and the individual spots are sharp. The lines are then rather diffuse and ill-defined. Rocking curves upon various Bragg reflections from the surface plane prove that the imperfection of a certain crystal does not exceed about 15 minutes, and that the projections through which the electrons pass are relatively thick. Estimates of imperfection and thickness made from rocking curves are in approximate agreement with those obtained from widths of Kikuchi lines.

A galena crystal which has been filed or ground parallel to a cube face exhibits two different sorts of surfaces. There are smooth "mirror" surfaces from which large blocks of the crystal have been mechanically torn, and there are very deeply scratched portions of the surface. The "mirror" surfaces give diffraction patterns which are qualitatively similar to patterns from cleaved surfaces, although there are notable differences. From mirror surfaces produced by filing, Kikuchi lines are very diffuse or are entirely missing, and diffraction spots form an extended array. The diffuseness of the lines and the extent of the array of spots correspond to great crystal imperfection, or to exceedingly thin projections. Reasons are advanced for believing in imperfection rather than extreme thinness.

The deeply scratched portions of the surface of a galena crystal give diffraction patterns which are entirely unlike patterns from cleaved surfaces. Before etching, Debye-Scherrer rings are produced. After a light or moderate etch a complex pattern appears, the nature of which is related to the angle between primary beam and direction of filing.

[1] *Transactions Electrochemical Society*, Vol. LXIX, 1936.
[2] *Phys. Rev.*, October 1, 1936.

The pattern is that of a mass of minute crystallites which have been rotated about an axis in the surface normal to the direction of filing, and in the sense determined by imaginary rollers which would be turned by slipping on the (0 1 0) plane. The magnitude of the rotation varies for different crystallites over a range from 5 to about 35 degrees. By alternate etching and examination by electron diffraction it is found that this layer of rotated crystallites extends beneath the surface to a depth of 0.003 mm.

Rotation of crystallites accompanying slip along slip planes is the mechanism reported to account for strain hardening in metals. This same rotation is observed in the present experiments on galena. It seems altogether possible that the simple technique of these experiments can be applied directly to study the disturbance in surface layers of metal crystals produced by abrasion. It may thus be a useful way of studying strain hardening in metals.

The Photoelectric Cell and Its Method of Operation.[3] M. F. JAMIESON, T. E. SHEA, and P. H. PIERCE. This paper gives a simple description of the laws governing the release of electrons from photoelectric surfaces, their collection at anodes, and the creation of ions in photoelectric cell gases by the "ionization" process, and discusses questions of spectral selectivity of various photoelectric surfaces, the influence of spectral characteristics of illumination, and the dynamic characteristics of vacuum and gas-filled cells.

Modified Sommerfeld's Integral and Its Applications.[4] S. A. SCHELKUNOFF. The purpose of this paper is to obtain a certain integral expressing the fundamental wave function and with the aid of this integral to calculate the radiation resistances of small doublets and small loops placed inside an infinite hollow cylinder. Some applications of this integral to calculation of radiation from parallel wires in free space are also discussed.

Diffusion of Water Through Insulating Materials.[5] R. L. TAYLOR, D. B. HERRMANN, and A. R. KEMP. Data are presented on the rate of water diffusion through various organic materials. A diffusion constant based on Fick's linear diffusion law is calculated for each material. Several equations are derived from Fick's law to show how valuable information can be obtained in connection with practical problems.

[3] *Jour. S. M. P. E.*, October, 1936.
[4] *Proc. I. R. E.*, October, 1936.
[5] *Indus. and Engg. Chem.*, November, 1936.

The effect of variations in methods and conditions of test is studied. The rate of diffusion through a water-sorbing material such as rubber does not obey Fick's law when under diffusion conditions favoring high water sorption.

Various concepts involving sorption and diffusion processes are discussed as bearing upon the mechanism of the diffusion of water through organic substances.