Abstracts of Bell System Technical Papers Not Appearing in this Journal

The Crystal Structure of Magnesium Platinocyanide Heptahydrate.[1] RICHARD M. BOZORTH and F. E. HAWORTH. Positions of the Mg and Pt atoms in crystals of $MgPt(CN)_4 7H_2O$. These have been definitely determined by means of x-ray oscillating-crystal photographs and Laue photographs, using the theory of space-groups. Because the other atoms are too light in comparison with the metal atoms, especialy Pt, their positions could not be determined. The Pt atoms are located at 0 0 0 and $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$, the Mg atoms at 0 0 $\frac{1}{2}$ and $\frac{1}{2}$ $\frac{1}{2}$ 0, in a tetragonal unit of structure 14.6A × 14.6A × 3.13A. Two units of structure are shown in the figure. The peculiar optical properties are believed to be associated with the unusual arrangement of the heavier atoms in widely spaced rows parallel to the tetragonal axis. In these rows Mg atoms alternate with Pt atoms, and the distance between any two adjacent atom-centers is 1.57A. The shortest distance between rows, however, is 10.3A, 6.6 times the distance between atoms in the same row. The atomic radii of Mg and Pt as determined by Bragg from other crystal data do not agree with the observed distance between these atoms, the calculated value being 2.7A, the observed distance 1.57A. The observed distance, however, is consistent with that calculated by the method of Davey, who assumes that the radius of an ionized atom differs much from the radius of the same atom un-ionized, and that the radii of Cs^+ and I^- are substantially equal in crystals of CsI.

Photoelectric Emission as a Function of Composition in Sodium-Potassium Alloys.[2] HERBERT E. IVES and G. R. STILWELL. The entire series of alloys of sodium and potassium have been investigated with respect to the relative values of the photoelectric currents produced by light polarized with the electric vector in and at right angles to the plane of incidence. The pure metals when molten exhibit values below three for the ratio of the two emissions; the alloys show three maxima at compositions approximately 20, 50, and 90 atomic per cent of sodium, with values from 10 to 30 for the ratio; the minima between show low values approximating those for the pure metals. The maxima and minima of the ratio of emissions are due to complicated variations in magnitude of the two emissions compared.

[1] *Physical Review*, Feb. 1927, Vol. 29, No. 2, p. 223.

[2] *The Physical Review*, Feb. 1927, Vol. 29, No. 2, p. 252.

Submarine Insulation with Special Reference to the Use of Rubber.[3] R. R. WILLIAMS and A. R. KEMP. (1) Soft vulcanized rubber, though not well adapted to some of the processes of manufacture of submarine cable, can be so made as to be mechanically and electrically suitable and to withstand the action of sea water in a manner comparable with that of gutta percha over a period of a few years. Whether such rubber will retain these characteristics for decades remains to be demonstrated, but it seems probable that it will.

(2) The principal factor to be controlled in producing this result is the amount of water absorbed by the rubber.

(3) Osmotic pressure of internal and external fluids is of prime importance in governing the in-flow of water into rubber and gutta percha.

(4) Lowered water absorption is achieved by removal of water-soluble matter from the rubber, the choice of an insoluble, non-reactive filler of suitable particle size and having a minimum of adsorbed gases or other contamination on its surfaces.

(5) The electrical characteristics of rubber compounds and of gutta percha are clearly related to their water content but are not simple functions of the water content.

(6) It appears that the mode of distribution of water is also extremely important.

(7) Most fillers for rubber compounds are not suitable for submarine insulation, either because of undesirable intrinsic electrical properties or because they are conducive to changes incident to water absorption. Hard rubber dust, silica and zinc oxide are the best fillers from these standpoints so far as known.

An Efficient Apparatus for Measuring the Diffusion of Gases and Vapors through Membranes.[4] EARLE E. SCHUMACHER and LAWRENCE FERGUSON. An efficient diffusion measuring apparatus, embodying a mechanical clamp and a mercury seal, is described. This apparatus can be used for measuring the rate of diffusion of gases and vapors through materials such as rubber, waxes, leathers and certain types of paper.

Investigation of the Thermionic Properties of the Rare Earth Elements.[5] EARLE E. SCHUMACHER and JAMES E. HARRIS. Thermionic emission measurements over a range of temperatures were made on samples of pure Ce, La, Pr, Nd, Sa and the aluminum alloys of Yt, Eu, Ga,

[3] *Jr. of the Franklin Inst.*, Jan. 1927, Vol. 203, pp. 35–61.

[4] *J. Amer. Chem. Soc.*, Vol. 49, 427 (1927).

[5] *J. Amer. Chem. Soc.*, Vol. 48, pp. 3108–3117 (1926).

Tb, Dy, Ho, Er, Th, Yb and Lu. These measurements showed the rare earth elements, without exception, to be more active thermionically than the commonly occurring metals. At 1800° C. all of these metals gave emissions of more than 10^5 that of clean tungsten at the same temperature.

The Solidus Line in the Lead Antimony System.[6] EARLE E. SCHUMACHER and FOSTER C. NIX. An investigation of the solidus line above the solid solution field for the lead antimony system was made by the quenching test procedure. Three points were determined between the melting point of pure lead and the end of the eutectic horizontal. The position of the solidus line has been precisely fixed.

Production Control.[7] C. G. STOLL. This paper treats the subject of production control from the practical rather than the theoretical point of view. It is confined largely to a description of the generally accepted principles of production control as applied in the Manufacturing Department of the Western Electric Company. This plant employs approximately 30,000 people and produces annually over $150,000,000 worth of manufactured products. These products are comprised of some 13,000 kinds of apparatus containing over 110,000 different parts.

The paper discusses the organization of the factory, which is set up along functional lines, and also the extensive system of records and charts used to facilitate the work of the organization and to assist in production control.

The Significance of the Dielectric Constant of a Mixture.[8] HOMER H. LOWRY. It is pointed out that in many cases it would be of great value to be able to calculate either the dielectric constant of a mixture of substances of known dielectric constants or, knowing the dielectric constants of a mixture of two components and that of one of the components, to calculate the dielectric constant of the other. A review of the literature, however, shows that this can be rarely accomplished. This is due mainly to the inadequacy of the theories of dielectrics, all of which are insufficiently developed to include the dielectric behavior of mixtures. Nevertheless, as is shown, many attempts have been made to develop formulæ of theoretical significance for application to mixtures. Inspection of the derivation of these formulæ shows that those with the best theoretical background are limited to such special cases that they are of practically no value.

[6] A. I. M. E. Pamphlet No. 1636-E, Feb. 19, 1927.
[7] *Mechanical Engineering*, Vol. 49, p. 201, 1927.
[8] *Jr. of the Franklin Institute*, 203, 413–439, 1927.

A brief review of these formulæ is given together with a brief account of the results of experimental investigations on the dielectric behavior of mixtures. A rather extended bibliography is given.

The Effect of Moisture on the Electrical Properties of Insulating Waxes, Resins and Bitumens.[3] J. A. LEE and HOMER H. LOWRY. The results of measurements of dielectric constant and effective conductivity at 1,000 cycles and resistivity are reported for 31 waxes, resins and bitumens, including not only naturally occurring products but also commercial dielectrics and mixtures. The measurements were made on the materials initially in a thoroughly dry condition, after six months' immersion in a salt solution corresponding qualitatively to exposure to 98 per cent relative humidity, and after having been redried. All the insulating materials studied absorbed water under the conditions of experiment. The absorption was least with the hydrocarbons and greatest with shellac and bayberry wax. In general, the greatest increase in capacity and conductivity and the greatest decrease in resistivity were shown by the materials which absorbed the most water. The percentage change was much greater in the conductivity and resistivity than in the dielectric constant, as was to be expected.

The Mechanism of the Absorption of Water by Rubber.[10] H. H. LOWRY and G. T. KOHMAN. Data are reported which show the influence of the various factors which determine the amount of water absorbed by any given sample of rubber. From a consideration of the results obtained, it was concluded that, at a given temperature, the most important external factor determining the amount of water absorbed by a given sample of rubber is the vapor pressure of water with which it is in equilibrium. The data show further that the water-soluble constituents within the rubber are responsible for most of the water absorbed at high humidities, that increasing the rigidity of a rubber compound decreases greatly the amount of water absorbed, and that aging increases the water absorption. It is pointed out that all the experimental facts are consistent with the view that the absorption of water by rubber consists of two processes: the formation of a true solution of water in rubber and the formation of solutions internal to the rubber of the water-soluble constituents of the rubber which can be removed by washing.

[9] *Jr. of Industrial and Engineering Chem., 19,* 302–306, 1927.
[10] *Jr. of Physical Chemistry, 31,* 23–57, 1927.

Rapid Evaluation of Baked Japan Finishes.[11] E. M. HONAN and R. E. WATERMAN. The service life of a japan film baked on metal can be evaluated by determining the rate of decomposition of the film when it is placed in an 8.5 per cent phenol-water solution. The effect of the time and temperature of baking the film and the cleanness of the metal previous to applying the japan can also be evaluated. The 8.5 per cent phenol solution is a desirable testing solution because its composition is quite constant at ordinary room temperatures and is not changed by the evaporation of the water.

Magnetostriction. L. W. MCKEEHAN.[1] This paper contains the principal part of three lectures given at the Franklin Institute in April 1926. The history of investigations on the changes in dimensions which accompany magnetization and the changes in magnetization which accompany forcible changes in dimensions is sketched and a classification of the rather complicated cases which have been examined is offered. The bearing of magnetostriction on theories of ferromagnetism is emphasized and a number of new experimental results are described. A representative bibliography is appended.

[11] *Ind. and Eng. Chem.*, Oct. 1926, Vol. 18, pp. 1066–1068.

[1] *Journal of the Franklin Institute* **202**, 737–775 (1926).