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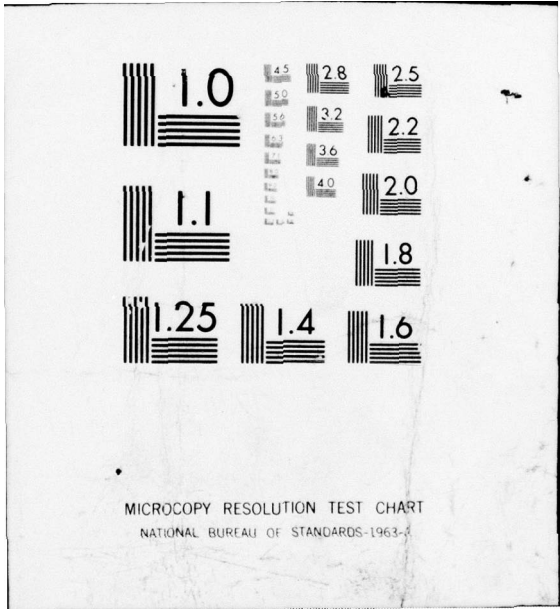
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15 July 1951

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AMERICAN EMBASSY

LONDON, ENGLAND

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KRYPTON 84 ISOTOPE LAMP

Dr. M. E. Engelhard of the Physikalische Technische Bundesanstalt, Braunschweig, Germany, has been studying the usefulness of the Kr^{84} isotope lamp as a source of monochromatic radiation. For this purpose it may be compared with the mercury 198 isotope lamp now frequently used in the United States. The Doppler broadening of the spectral lines of mercury is less at any given temperature than that found with krypton, but the krypton lamp may be operated at a much lower temperature, the freezing point of nitrogen, where its vapor pressure is still adequate for a brilliant discharge. The Doppler broadening at this temperature is about 20 percent less than that found with the mercury lamp at room temperature. Path-length differences as high as 80 cm have been observed.

The lamps used by Dr. Engelhard are filled to one atmosphere of krypton at room temperature and the vapor pressure falls to the correct value when the temperature is reduced. There is thus no change in the properties of the lamp due to "clean-up", i.e., a change in concentration of the gas.

Both the 84 and the 86 isotope have been studied but the 84 isotope is preferred because the wavelength found is almost exactly that found with natural krypton. This has the advantage that natural krypton can be used for all but the most accurate experiments. The krypton isotopes were separated by K. Clusius and G. Dickel.

CONFERENCE ON PHASE CONTRAST

A conference on Phase Contrast and Interference Contrast was held at the Institute of Optics in Paris on May 15-21, 1951. Sixty-seven delegates were present from 12 countries. There were two papers on biological topics, five on novel applications of phase techniques, and 14 concerned solely with the optics of phase and interference phenomena.

The emphasis of the papers was on the prediction and observation of the relationship between the object and its image. There seemed to be a note of unrest and uncertainty among those who use phase microscopes, as it became obvious that the appearance of an object through a phase microscope bears only a distant relationship to its actual form. As was pointed out by Dr. C. P. Saylor of the National Bureau of Standards, Washington, the "full comprehension of the form of an object can be acquired only by employing a variety of procedures".

In particular, the optical system which is suitable for observing the fine details of an object will in general not show the larger details. This was illustrated in a paper by L. C. Martin and J. V. Ramsey (London) who observed polish and index of refraction defects in glass plates using phase discs of various angular sizes, sometimes in combination with phase rings.

A paper by H. H. Hopkins (London) discussed the visibility of simple objects which arises by their refraction of light outside the objective of the microscope.

M. Locquin (Paris) described the way in which an interference filter can be used as a phase ring whose phase retardation can be varied by a small change in the illuminating wavelength. The illumination is conveniently done through another interference filter which is tilted slightly to change the transmission wavelength.

E. Ingelstam (Stockholm) in a series of papers discussed the application of phase contrast to the measurement of refractive index gradients, optical grating errors, and wind tunnel observations (cf. ESN 5, 95 (1951)).

The resolving power of phase contrast microscopes was treated theoretically by M. Françon (Paris) and A. Saez

(Madrid), who showed how it increased with an increase of the diameter of the phase ring, being limited finally by the aberrations of the condenser. Françon also delineated in another paper the cases in which interference methods are superior to phase methods and vice versa (cf. Rev. d'Opt. 30, 221 (1951)).

The proceedings of the meeting will probably be published by Revue d'Optique, 3 Blvd. Pasteur, Paris.

INTERNATIONAL DISCUSSION ON MOLECULAR SPECTROSCOPY

An informal international conference on "Molecular Spectroscopy" organized by Professors E. Miescher (Basel) and R. Mecke (Freiburg i.Br.) was held at Basel June 28-30, 1951. About 150 scientists representing the United States, Great Britain, and most western European countries attended. This surprisingly large interest may stimulate the repetition of such meetings during forthcoming summers.

The 50 contributions dealt with astrophysical, chemical, physical, and optical aspects of ultraviolet, infrared, and visible spectroscopy; the almost complete absence of Raman spectroscopy from the discussion is noteworthy in indicating current trends of interest.

Technical Report ONRL-62-51, summarizing some of the papers, will be available from the Technical Information Division, Code 250, Office of Naval Research, Washington 25, D. C.

Negative Hydrogen Ions

Convincing experimental evidence was presented by Lochte-Holtgreven (Kiel) that negatively charged hydrogen ions can exist under laboratory conditions. Previous calculations by Chandrasekhar have suggested that practically all the sunlight comes from this species. In this work experiments were performed using pure hydrogen at effective temperatures of 10,000°K and 13,000°K and at pressures of 1 and 50 atmospheres respectively. Calculations performed in Prof. Unsöld's Institute have indicated that these are the conditions under which there will be a concentration of both electrons and free atoms such that the absorption continuum produced by the hydrogen atoms and the hydrogen anions will be about equal. A

comparison of observed and calculated line intensities of the H α line indicates that the contribution of the hydrogen anions must be taken into account. Experiments were also tried at very high pressures leading to similar conclusions.

Energy Level Splittings in Complex Ions

The splitting of energy levels of ions in aqueous solutions was discussed by H. Hartmann (Frankfurt). His results provide a clear illustration of the manner in which the electrostatic effects of ligands in complex ions effect a splitting of the ground state of the central ion. The near ultraviolet absorption spectra of the trivalent ions of Ti, V, Cr, and Mn were satisfactorily interpreted under the assumption of octahedral symmetry in their complexes formed with water molecules. In all these ions the difference between the first two electronic levels is so great that the corresponding absorption should be in the very far ultraviolet. The absorption spectra are due to the splitting or splittings mentioned above.

Titanium and manganese both have a D ground state and the splitting is estimated on theoretical grounds to yield an absorption band around 550 m μ . The observed bands are around 450 m μ . $[\text{Ti}(\text{H}_2\text{O})_6]^{3+}$, solid titanium alum, and solid caesium manganese alum were also investigated. The ground state in vanadium and chromium is an F term which splits into a triplet, yielding two absorption bands with maxima around 400-600m μ . These were observed in $[\text{V}(\text{H}_2\text{O})_6]^{3+}$ and also in alcoholic solutions of VCl_3 . The splitting is reduced in $[\text{V}(\text{alcohol})_6]^{3+}$ itself and the maxima are displaced to longer wavelengths.

Bond Dipole Moments

H. W. Thompson (Oxford) presented valuable new results on bond dipole moments obtained from intensity studies and also on low temperature crystal spectra. The infrared band intensities were obtained using Wilson's method of pressure broadening. CO_2 , CO_s , CS_2 , N_2O , C_2H_2 , CH_3F , CH_3Cl , CH_3Br , and CH_3I were investigated and some of the quantitative results are summarized in the following table:

<u>Molecule</u>	<u>Bond</u>	<u>$\frac{\delta\mu}{\delta r} \times 10^{10}$</u>	<u>Moment, μ</u>
CH ₃ Cl	C-Cl	2.4	0.4
	C-H	1.4	
CH ₃ Br	C-Br	1.9	0.5
	C-H	1.1	

Table, Contd:

CH ₃ I	C-I	1.0	
	C-H	0.9	0.5

Addition Compounds of Boron Trifluoride

A large number of addition compounds of BF₃ have been studied by means of Raman spectroscopy during the past several years in the laboratories of Prof. J. Goubeau (Göttingen). Three distinct problems arise in these studies:

- (1) Structural changes in BF₃ in the addition compounds,
- (2) The nature and strength of the binding forces between the boron atom and the nitrogen, oxygen, etc. of the added compound,
- (3) Changes undergone by the added molecules.

The force constants in the BF₃ unit do not change much upon formation of addition complexes; the bonds between the boron and nitrogen or oxygen atoms are also quite normal single bonds, whose strength is not very different from that of the BF bonds.

The changes in the added molecules are more marked and useful information can be obtained about these by studying the changes in their characteristic frequencies. The results indicate a plausible alternating effect on the strength of the bonds, as the bond immediately next to the coordinating link is weakened, the next one is strengthened, the next one is weakened, etc. Very similar effects are obtained if protons are used instead of boron trifluoride such as in coordination compounds with aluminum trichloride.

Infrared Frequencies of the Carboxyl Group

The infrared absorption bands of the carboxyl group in acid dimers were identified by Sheppard and Hadzi (Cambridge). To avoid the ambiguity usually caused by the simultaneous presence of both monomeric and dimeric carboxylic acids, this work was carried out in the crystalline or pure liquid phase; the systems investigated thus consisted essentially of purely dimeric acids. A series of 18 acids was investigated; these included both simple and long chain, monocarboxylic and dicarboxylic acids. The effect of replacing the hydrogen atom of the carboxyl group by deuterium was also investigated in each case.

In the spectral region from 1500 and 5000 cm^{-1} , three main changes were observed on deuteration. The band at 1420 cm^{-1} disappears on deuteration and is replaced by a new band at 1050 cm^{-1} . This was identified as the "in plane" deformation frequency of the OH or OD bond. The strong broad band at 930 cm^{-1} also disappears in deuteration and is replaced by a new band at 660 cm^{-1} . This is identified as the "out of plane" deformation frequency of the OH or OD bond.

The 1300 cm^{-1} band of the hydrogen acids appears at somewhat higher frequencies in the deuterio acids. This band is due to the C-O stretching mode.

STRUCTURE OF LIQUID SLAGS

Dr. J. O'M. Bockris of the Department of Chemistry, Imperial College of Science and Technology, London, is studying the structure of liquid oxides and silicates (see also ESN 4, 216 (1950)). The data provided by this work is of great value in understanding the behavior of complex metallurgical slags.

The structure of these liquids is being investigated through measurements of electrical conductivity, electrolytic behavior, and viscosity. The conductivities of a large number of substances have been measured and the applicability of Faraday's law has been studied. A deviation from the Faraday law indicates non-ionic conduction, but of the many metal oxides and silicates investigated only MnO has shown appreciable deviation. In this case, 80 percent of the conduction is ionic, the balance presumably being electronic.

Some measurements of transport number are also being made. For example, the transport number of the cation in $\text{K}_2\text{O}\cdot\text{SiO}_2$ was found to be about unity, within the experimental error; i.e., virtually none of the current is carried by the silicate ion.

Measurements of the viscosity of silicates of the type $\text{Metal}_x\text{O}_y\text{SiO}_2$ will be made shortly by the rotating crucible method. The apparatus consists essentially of a graphite rod dipping into the liquid silicate contained in a rotating crucible. The torque applied by the rotating liquid to the graphite rod is balanced by an opposing torque applied

magnetically to an armature attached to the upper end of the rod. After suitable calibration, the magnetising current then becomes a measure of the viscosity of the liquid. The viscosity in turn is expected to give valuable information on the structure of the silicate.

SEX HORMONES IN DIABETES

On 3 July 1951, Prof. B. A. Houssay of the Institute de Biologia Medicina Experimental, Buenos Aires, delivered the Third Ciba Foundation Lecture on "Sex Hormones in Diabetes". He discussed the work of his laboratory on sex hormones and experimentally produced diabetes in laboratory animals. Male rats were found to be more susceptible to diabetes produced by subtotal pancreatectomy than were females. Gonadectomy in young adult rats of both sexes reduced, but did not eliminate, this difference. Experiments in which gonadectomy is performed at a very early age are underway.

In further experiments partially pancreatectomized rats were treated with androgens or estrogens. Diabetes developed quicker and its severity and incidence were greater in the androgen than in the estrogen treated rats. The effect of other related steroids was studied in the same manner but their effect on the diabetes appeared to be directly related to their androgenic or estrogenic activity. Diethylstilbestrol differs from natural estrogens in that it causes an early transitory diabetogenic action followed by the antidiabetic action shown by the natural estrogens. The early phase is abolished in force feeding experiments.

Pair feeding experiments were used to determine that the effect of natural estrogens and androgens on the diabetes is not due to their effect on food consumption. The principal physiological effect of the sex hormones is to modify the number of islets of Langerhans. Testosterone caused a reduction in the amount of islet tissue, whereas estrogens caused the proliferation of new islet tissue from the centro-acinar cells. The islet tissue of stilbesterol treated animals was found to be four times greater than normal.

GENETICAL ANALYSIS OF DRUG RESISTANCE

At the First International Symposium of Chemical Microbiology held in Rome 25-30 June 1951, Dr. L. Cavalli,

Laboratori scientifici dell'Istituto Sieroterapico Milane-
nese, Milano, presented his views on "Genetical Analysis
of Drug Resistance".

The discovery of a sexual phase in E. coli by
Lederberg and Tatum has made another type of experimental
approach possible in studying drug resistance in bacteria,
namely, Mendelian analysis.

Investigations by Cavalli and co-workers demon-
strate the first case of genetical analysis of gradual re-
sistance, also called the "penicillin pattern" after Demerec.
Gradual resistance is easily explained 'a priori' by the
theory of physiologic adaptation. It also can be explained
on the alternative theory of genetic adaptation on the basis
of a complex picture of inheritance, namely that of a number
of interacting loci, each contributing by mutation a low
degree of resistance, adding up when more loci have mutated
to give higher and higher resistance. This polygenic picture
was in fact borne out by the results of bacterial crosses.

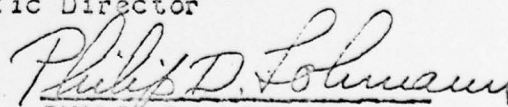
On the whole, the results of the crosses support
the hypothesis of gene mutations determining resistance, full
or gradual; whether any room is left, in the latter case, for
non-genetic adaptation of the "after" type cannot be fully
answered at present. In any event, the results warrant the
hope that microorganisms can offer excellent opportunities
for the investigation of the "bete noire" of genetics, namely
polygenic inheritance.

FORTHCOMING EVENTS

The following meetings are considered to be of
future interest to American scientists:

<u>Date</u>	<u>Meeting</u>	<u>Place</u>
5-19 Sept	Special Meeting of the Iron and Steel Institute (correction)	Austria
8-10 Oct	German Geophysical Society	Stuttgart

Prepared by the Scientific Staff
Submitted by Dr. S. R. Aspinall
Deputy Scientific Director



PHILIP D. LOHMANN
Captain, U.S.N.

Assistant Naval Attache for Research

