More detailed data connected with the description of the heat-treated iron-carbon alloys will be published elsewhere.

W. J. WRAZEJ

Metallurgy Department,
Royal School of Mines,
Imperial College of Science and Technology,
London, S.W.7.
Aug. 23.

¹ Epstein, S., "The Alloys of Iron and Carbon", vol. 1, "Constitution" (New York, McGraw-Hill Book Co., Inc., 1936).

² Wrazej, W. J., *Nature*, 158, 308 (1946).

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⁴ Dannatt, C. W., and Wrazej, W. J. (in preparation).

Deviation at Vertical Incidence in the Ionosphere

It was pointed out by Booker¹ ten years ago that even at vertical incidence the ordinary and extraordinary rays are deviated in the ionosphere, an effect that may be explained by the change in direction of the associated Poynting vectors. They are deviated in opposite directions from the vertical in the earth's magnetic meridian plane, and at their reflexion points they make angles with the vertical of D and $\tan^{-1}[\sin 2D/(3 - \cos 2D)]$, respectively, where D is the angle that the earth's field makes with the horizontal.

The latter deviation has a maximum value of $19^\circ 28'$ when $D = 35^\circ 16'$; but under conditions when the earth's field is within, say, 30° of the vertical, the horizontal distance between the ordinary and extraordinary reflexion points can be as much as 50 km. for the F layer for frequencies close to the ordinary critical frequency. It follows that at times when large horizontal gradients exist in the ionosphere, the electron densities at the reflexion points for the ordinary and extraordinary critical frequencies can be markedly different.

Little mention of this possibility has so far been made in connexion with ionospheric sounding, but it appears that the effect can be large enough to influence the detailed interpretation of vertical incidence records. The deviation of the rays by the magnetic field, and by the horizontal gradient itself, may have an appreciable effect on the separation of the ordinary and extraordinary critical frequencies, and may account in part for the occasions when it differs markedly from its normal value. Alternatively, caution must be exercised, when using the separation as a measure of the gyro-frequency, in interpreting such variations as due to changes in the value of the earth's magnetic field.

In conclusion, we may remark in connexion with ionospheric observations made during an eclipse, when marked horizontal gradients of density must occur near the edges of the totality belt, that this effect may be of significance both with regard to the optimum siting of the sounding station, and to the conclusions drawn concerning the density changes caused by the eclipse.

G. MILLINGTON

Research Division,
Marconi's Wireless Telegraph Co., Ltd.,
Great Baddow, Essex.
Aug. 31.

¹ Booker, H. G., *Phil. Trans. Roy. Soc., A*, 237, 425 (1938).

Synthesis of Poly-Aspartic Acid

IN previous publications we have reported on the polymerization of representatives of normal¹ and of basic² α -amino-acids. In the present communication the synthesis of poly-aspartic acid is dealt with as an example of the polymerization of a trifunctional acidic α -amino-acid.

A suitable monomer was found in the N-carboxy anhydride of L-aspartic acid β -benzyl ester,

The reversible masking of the β -carboxyl group by the benzyl ester group ensures the exclusive participation of the α -carboxyl group of the aspartic acid in the peptide linking of the monomeric units. The monomer was obtained in the following way. The di-silver salt of N-carbobenzoxy L-aspartic acid (II)³ gave with benzyl iodide in ether N-carbobenzoxy L-aspartic acid dibenzyl ester (III); partial hydrolysis by the calculated amount of potassium hydroxide in benzyl alcoholic solution affected the benzyl group attached to the α -carboxyl group only, and yielded the N-carbobenzoxy aspartic acid β -monobenzyl ester (IV). On suitable treatment of the latter with phosphorus pentachloride, the monomer I was obtained. The intermediate chloride (V)

was not isolated. The results of elementary analysis are consistent with formula I, but do not exclude the isomeric N-carbobenzoxy aspartic acid anhydride (VI)⁴,

the formation of which is also conceivable from (V) on loss of benzylchloride.

Some of the facts which prove that the substance obtained is different from (VI) and correctly represented by formula I are as follow: (i) the melting point found (111° , with evolution of carbon dioxide) is different from that of (VI) (124°)⁴, and is depressed by the admixture of a preparation⁴ of the latter; (ii) the ninhydrin colour reaction is positive; (iii) on heating, evolution of gas occurred, the loss of weight being in agreement with the calculated value of one mole carbon dioxide per mole of (I); the polymer obtained has the elementary composition to be anticipated in using a monomer of the formula I, and gives a strong biuret reaction.

In accordance with previous experience², monomer I was carefully dried in the polymerization vessel in high vacuum, first at room temperature and then at 60° , prior to the polymerization, which was carried out in high vacuum with stepwise raising of the temperature. At 109° , melting occurred with strong evolution of gas, causing a definite increase in pressure. On its decrease, the temperature was raised to 125° and the heating continued until evolution of gas appeared to have ceased entirely. The solid reaction product, giving a strong biuret reaction, is, according to analytical data, the poly-aspartic acid β -benzyl ester (VII):