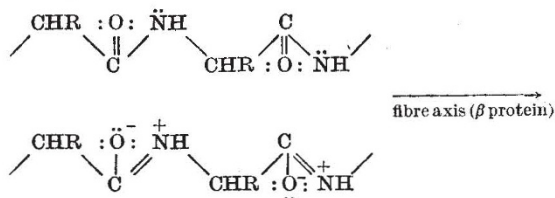


(for example,  $\text{HSO}_4^-$ ,  $\text{ClO}_4^-$ ) lie between the lattice planes of the graphite.

The high electron mobility in conjugated systems, arising from the delocalized  $\pi$  orbitals, thus gives rise to very distinctive properties. Moreover, Mulliken has shown that a certain degree of conjugation ('third order' conjugation or 'hyperconjugation') exists even in fully saturated organic molecules. Hyperconjugation is a delocalization effect whereby C-H bonds tend to donate electrons to C-C and other bonds, and this is found to be a stabilizing influence in all organic molecules. It would appear, therefore, that there is an incipient injection of electrons into the chain and a certain degree of longitudinal electron mobility (quasi-conductivity) in any organic system. This effect is much increased whenever multiple bonds are also present. In this connexion, Bateman and Jeffrey<sup>7</sup> have recently observed a significant degree of bond shortening (to 1.43 Å.) in the central bond of a 1:5 diene (geranylamine hydrochloride).

Mulliken has suggested that C=O groups can give rise to a very energetic type of hyperconjugation. Shortening has been observed in the C-C bonds in  $\text{CH}_3\text{CHO}$  (to 1.50 Å.)<sup>8</sup> and in oxalic acid (to 1.43 Å.)<sup>9</sup>.

A system of this type is the polypeptide grid of the proteins in which the C=O bonds are in the 1:5 position to each other. Two alternative formal bond structures can be written as follows (see also Huggins<sup>10</sup>).



This system would be expected to have an appreciable electron mobility over the full length of the molecule and along the axis of the protein fibre. This may be of importance in connexion with the activity of nerve and muscle. By contrast, the fibres of plants, in which there is no nervous system of the type existing in animals, is based on cellulose. In this substance, opportunities for conjugation are much smaller than in protein. Cellulose fibres would thus be expected to show a lower electrical and optical activity and a higher chemical stability than corresponding fibres based on protein.

K. G. DENBIGH.

Chemistry Department,  
University College,  
Southampton.  
Sept. 9.

<sup>1</sup> Denbigh, *Trans. Faraday Soc.*, **36**, 936 (1940).

<sup>2</sup> Mulliken, *J. Chem. Phys.*, **7**, 14, 20, 121, 339, 353, 356, 364, 570 (1939); **8**, 234, 352 (1940). *J. Amer. Chem. Soc.*, **63**, 41, 1770 (1941).

<sup>3</sup> London, *Trans. Faraday Soc.*, **33**, 8 (1937).

<sup>4</sup> London, *J. Phys. Chem.*, **46**, 305 (1942); see also *C.R.*, **208**, 2059 (1939).

<sup>5</sup> Herzfeld, *Phys. Rev.*, **29**, 701 (1927).

<sup>6</sup> Weiss, *Nature*, **145**, 744 (1940).

<sup>7</sup> Bateman and Jeffrey, *Nature*, **152**, 446 (1943).

<sup>8</sup> Stevenson, Burnham and Schomaker, *J. Amer. Chem. Soc.*, **61**, 2922 (1939).

<sup>9</sup> Robertson, J. M., *J. Chem. Soc.*, 131 (1938).

<sup>10</sup> Huggins, *Chem. Rev.*, **32**, 195 (1943).

## Red Stannous Oxide

A CENTURY ago, Fremy<sup>1</sup> and Roth<sup>2</sup> described the preparation and properties of red forms of stannous oxide. More recently, Bury and Partington<sup>3</sup> and Weiser and Milligan<sup>4</sup> were unable to obtain these. The matter seemed worth investigating again in the light of a paper by Ehret and Greenstone<sup>5</sup> on red zinc oxide.

In work still in progress, it has been found possible to obtain products in all respects identical with those described by Fremy and by Roth, though by slightly different experimental procedures.

Fremy's method of preparation was modified by precipitating a solution of stannous chloride, containing hydrochloric acid, with excess of aqueous ammonia, heating the resulting thick suspension of stannous hydroxide for some time on the water bath, and finally evaporating thin, even films of the suspension to dryness in large porcelain dishes. After repeatedly decanting with boiled distilled water, and drying in vacuum, a deep orange powder is obtained.

Roth's oxide was obtained by heating a suspension of stannous hydroxide in very dilute acetic acid in presence of sodium hypophosphite. The product is deep crimson and of larger grain size than that obtained by Fremy's method.

The presence of free tin in the red oxides could not be established by amalgamation or by conductivity measurements. X-ray diffraction powder photographs taken with cobalt  $K\alpha$  radiation showed the patterns from the two red oxides to be identical, but different from those of normal tetragonal stannous oxide and of stannous hydroxide.

The red stannous oxide appears, therefore, to be a distinct crystalline modification.

J. R. PARTINGTON.  
W. MOSER.

Department of Chemistry,  
Queen Mary College,  
University of London;  
c/o Chemical Laboratory,  
University of Cambridge.  
Oct. 30.

<sup>1</sup> Fremy, *C.R. Acad. Sci.*, **15**, 1108 (1842); *Ann. Chim. Phys.*, (3), **12**, 460 (1844).

<sup>2</sup> Roth, *Jahrb. der prakt. Pharm.*, **10**, 381 (1845).

<sup>3</sup> Bury and Partington, *J. Chem. Soc.*, **121**, 1998 (1922).

<sup>4</sup> Weiser and Milligan, *J. Phys. Chem.*, **36**, 3039 (1932).

<sup>5</sup> Ehret and Greenstone, *J. Amer. Chem. Soc.*, **65**, 872 (1943).

## Mr. F. Lincoln and the Cavendish Laboratory

MR. F. LINCOLN, who has been on the staff of the Cavendish Laboratory for fifty-four years and has been laboratory steward since 1902, retired on September 30. Generations of research students have passed through the Laboratory during the years of Lincoln's reign, and he is widely known to physicists throughout the British Empire and in other countries.

We are making him a presentation to mark our gratitude for his long and devoted service to the Laboratory, and I have written to past and present Cavendish men inviting subscriptions. There must however, be many whom I have not been able to reach by a letter, and I would be glad to receive contributions from readers of *Nature* who wish to be associated with this gift to Mr. Lincoln.

W. L. BRAGG.

Cavendish Laboratory,  
Cambridge.