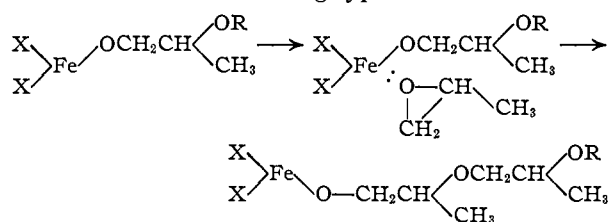


amorphous polymer evidently occurs during polymerization since monomer recovered from a polymerization experiment after two days at 80° had lost no optical activity.

We ascribe the difference in melting point between the crystalline polymers prepared by the two catalysts to the great difference in molecular weight, since the optical rotations, infrared spectra and X-ray spacings for the two materials were identical. The principal X-ray diffraction lines at 4.25 and 5.20 Å. and the density (1.03) are consistent with a model involving a compressed *trans* zig-zag chain.

These observations further support the accumulating evidence⁴ that the configuration of the asymmetric centers along a polymer chain have a remarkable influence on the physical properties and that polymerization catalysts can exert a remarkable degree of steric control on the configuration of these asymmetric centers.

The fact that amorphous polypropylene oxide of random configuration and crystalline polymer with all centers of the same configuration are formed simultaneously suggests that two different catalyst sites are present. We believe that this high degree of steric selectivity may be accounted for by a mechanism of the following type.



If the iron atom of this alcoholate were at solid surface, the steric requirements for the intermediate coordination might be rigid enough to produce oriented polymer. A soluble catalyst of similar structure might be responsible for the amorphous polymer.

(4) C. E. Schildknecht, S. T. Gross and A. O. Zoss, *Ind. Eng. Chem.*, **41**, 1998 (1949); H. Staudinger, "Hochmolekulare organische Verbindungen," Springer, Berlin, 1932, p. 295; G. Natta, *J. Polymer Sci.*, **16**, 143 (1955); C. W. Bunn and E. R. Howells, *ibid.*, **18**, 307 (1955).

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RECEIVED DECEMBER 21, 1955

THERMO-OSMOSIS OF RARE GASES THROUGH A RUBBER MEMBRANE¹

Sir:

Using an apparatus similar to the "membrane assembly B" of Denbigh and Raumann² we have observed the thermo-osmosis through a rubber membrane of carbon dioxide and of all the rare gases except radon, and have calculated from the experimental data the heats of transfer Q^* and the permeabilities p . The calculation of p was carried

(1) This paper is based upon the dissertation submitted by R. J. B. to Stanford University in partial fulfillment of the requirement for the Ph.D.

(2) K. G. Denbigh and G. Raumann, *Proc. Roy. Soc. (London)*, **A210**, 518 (1952).

out by the method of Denbigh and Raumann.³ Table I shows our results along with the few other comparable results that we have found in the literature.

TABLE I

Gas	Run	T , mean, °C.	Q^* , 10 ³ cal./ mole	p (Pres. exp.), 10 ⁻⁸ cm. ² / sec.-atm.	p (lit.) 10 ⁻⁸ cm. ² / sec.-atm.
CO ₂	1	33.0	- 9.8 -18.6 ³		
He	2	34.0	+11.2	33.7	33 (at 35°) ⁶
	3	34.0	+11.4	53.4 ⁴	17 (at 25°) ⁶
Ne	4	34.5	+ 9.0	8.6	
A	5	34.5	- 0.6		
	6-7			22.0	
	7	34.5	+ 0.3		
Kr	8	34.5	- 1.7	48.4 ⁴	
Xe	9	34.5	- 3.2	73.5 ⁴	33 (at 25°)

The principal difference between our method and that of Denbigh and Raumann is that we read the temperatures at the two sides of the rubber membrane directly from two thermocouples whose "hot" junctions were respectively flush with the two surfaces of porous bronze adjacent to the rubber membrane, whereas the authors mentioned used thermocouple junctions imbedded in the porous bronze and found the surface temperatures by extrapolation. Either method would seem to be subject to systematic errors. From the first of our runs to the last, we left the membrane assembly undisturbed save for the degassing and admission of gas involved in changing from one gas to the next. Because of this, the systematic errors were probably the same in all of our runs, and we therefore believe that our values of Q^* and p are rather better relatively than absolutely. Our value of p for helium agrees satisfactorily with that of Van Amerongen, and the differences between our values and those of Norton, for helium and xenon, we attribute to the differences of temperature.⁷

(3) K. G. Denbigh and G. Raumann, *ibid.*, **A210**, 377 (1952).

(4) These permeabilities are based on fewer data than our others.

(5) G. J. van Amerongen, *J. Applied Phys.*, **17**, 972 (1946).

(6) F. T. Norton, *J. Chem. Phys.*, **22**, 1145 (1954).

(7) Details of our experimental work, together with an account of the theory, are given in the dissertation mentioned in Footnote (1), and will be published in a later paper. The dissertation itself will be available from University Microfilms, 313 N. First St., Ann Arbor, Mich.

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RICHARD J. BEARMAN
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RECEIVED NOVEMBER 10, 1955

REDUCED UROPORPHYRIN III IN THE BIOSYNTHESIS OF HEME¹

Sir:

The role of uroporphyrin and coproporphyrin in heme biosynthesis, although long a matter of speculation, is now becoming clearer. Rimington² has recently suggested that these tetrapyrroles actually are not in the main pathway of heme biosynthesis, but rather are oxidation products of heme precursors, or porphyrinogens. In addition,

(1) Aided by a grant from the Dazian Foundation.

(2) C. Rimington, *Endeavour*, XIV (55), 126 (1955).