Nuclear Magnetic Resonance of High Polymers (Phase Transition of P. V. A. Fibers)

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It is known that P. V. A. has a phase transition of the second order between about 60°C and 120°C[1], but the mechanism of the transition is not clear. In this connection, the line shape of the proton resonance in P. V. A. has been studied as the function of temperature.

The samples used were P. V. A. fibers "Mewlon" prepared by Dai Nippon Spinning Co. Ltd. in the following way: saponified vinylacetate, P. V. A., was spun through a solution of a mixture of zinc sulphate and glaubesalt. After washing with methanol, these fibers were sealed in an evacuated glass tube.

We have used the usual apparatus, composed of an autodyne oscillator, a lock-in-amplifier and a recorder as shown in Fig. 1, and the field intensity is about 3000 gauss.

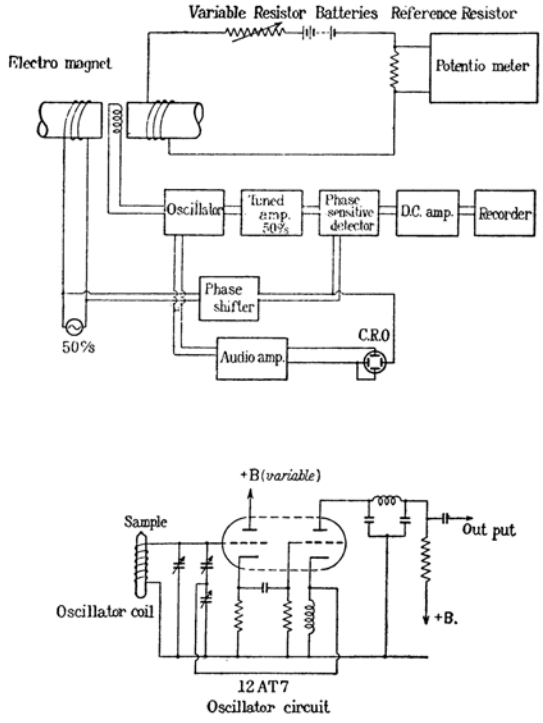

Fig. 1

Some of the experimental results of the line shape are shown in Fig. 2. Both the line width and the second moment were

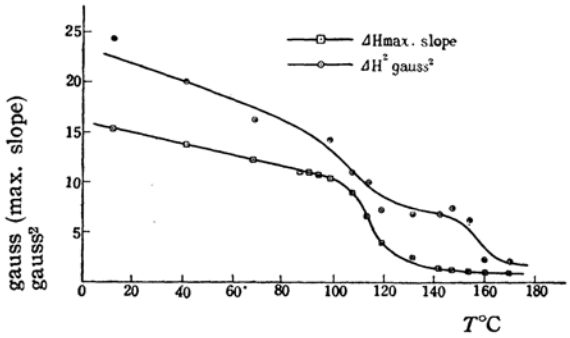

Fig. 3

shown in Fig. 3 as the function of temperature. The derivative curves of proton resonance at 48°, 84° and 94°C may be interpreted to be composed of two parts; one is at the center and very narrow in width and the other very broad. The central component becomes more sharp and intense with temperature. The broad part becomes narrower with temperature and disappears at about 170°C. The values of the experimental second moment decrease gradually with rise of temperature. The gradual narrowing of the width and the experimental second moment are attributed to the development of thermal motions including rotations and oscillations of the protons.[2)]

The central peaks of the curves may be assumed to be due to the thermal motion of the water molecule adsorbed by the sample.

The results of more detailed considerations on the effect of crystallization on the phase transition and the appearance of the central peaks will be published later.

The authors wish to express their appreciation to Prof. Masatami Takeda for his kind discussion on our works.

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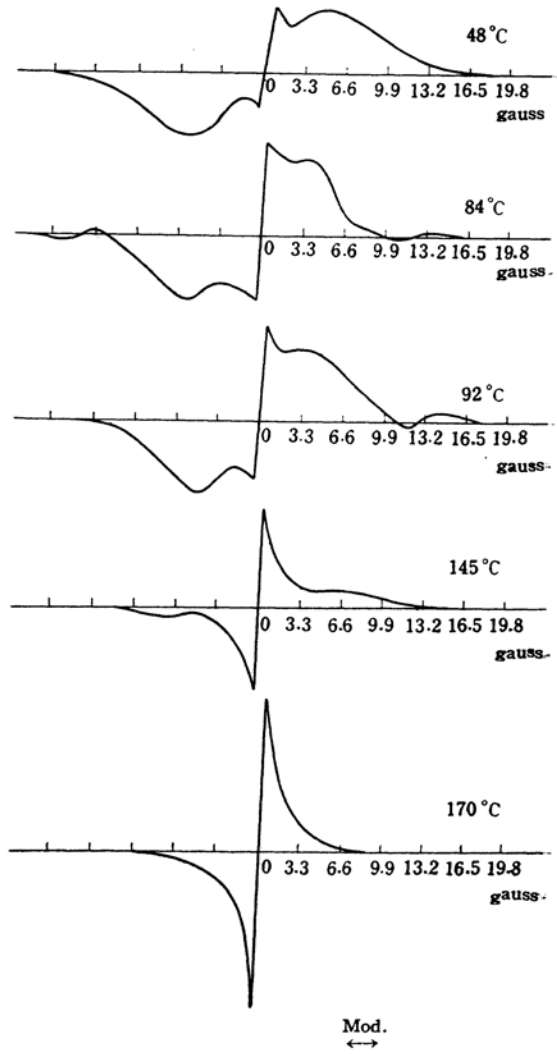

Fig. 2

1) Y. Yano, *J. Chem. Soc. Japan*, 73, 708 (1952).
2) W. P. Slichter, *J. Appl. Physics*, 26, 1099 (1955).