Many nematic liquid crystals, when cooled to temperatures below the normal melting point, form a phase which is not the equilibrium crystalline solid. This behaviour has been shown in MBBA, (1) which will be the subject of the present paper.

If this non-equilibrium phase is a glass which has a spatial distribution of molecules very similar to that of the liquid crystal, but without the attendant molecular mobility, it may prove very useful in elucidating those aspects of the transport properties which do not depend on large scale molecular motion. Put another way, the hypothetical existence of such a glass opens the possibility that one part of a given transport property may be frozen out, permitting the measurement of the component remaining. For instance, one might be able to reduce greatly the ionic contribution to charge transport and thus measure any electronic contribution that might remain.

The present work is preliminary. Its objective is to demonstrate that the low temperature non-equilibrium phase of MBBA is in fact an amorphous (i.e. non-crystalline) one whose structure is closely related to that of the liquid crystal, and that at least one transport property can be measured and related to its high-temperature analog.

The transport property chosen was the thermal conductivity. The frozen-out part would be due to molecular transport, the remaining part, to lattice vibrations. The measurements in these preliminary experiments are not yet sufficiently accurate to permit the frozen-out and remaining parts to be distinguished.
However, the numbers show unambiguously that the anisotropy of of the liquid crystal phase continues into the quenched phase. This result, together with the structural information which demonstrates that the quenched phase is amorphous yet related to the equilibrium phases, achieves the stated objective.

STRUCTURE DETERMINATIONS

The material used in all these experiments was supplied by Eastman Chemicals. In the X-Ray and optical experiments a droplet was placed on a microscope slide and was plunged into liquid $N_2$. The slide and congealed specimen were then placed into the apparatus and examined in the appropriate temperature range.

A. X-Ray Diffraction

The X-Ray diffraction patterns of the quenched, crystalline and liquid crystalline forms of MBBA appeared in temperature sequence, as expected (1). As shown in Fig. 1, the crystalline phase gave a strong reflection at $2\theta = 5.2^\circ$.

![Fig. 1. X-ray diffraction intensity as a function of angle at three temperatures. The solid curve B was obtained with the crystalline intermediate-temperature phase. The dashed curve was obtained both with the high-temperature (liquid crystalline) phase C, and with the quenched phase A.](image)

When a quenched sample at liquid $N_2$ temperature was placed in the diffractometer set at this angle, the observed intensity rose from an initial "background" value to a peak while the sample warmed and eventually crystallized. The intensity