THE ELECTROPHYSICAL PROPERTIES OF POLYTOLANS AND POLYDIPHENYLBUTADIYNE AND THE RELATIONSHIP BETWEEN THESE AND SUPERMOLECULAR STRUCTURE*

A. M. Fomin, V. M. Misin, L. A. Berkovich and M. I. Cherkashin

V. I. Ulyanov-Lenin State University, Kazan'
Institute of Chemical Physics, U.S.S.R. Academy of Sciences

(*Received* 20 *September* 1976)

A polymer of tolan, obtained by thermal polymerization, and polymers of tolan and diphenylbutadiyne, obtained by anionic polymerization, have been studied by the space charge-limiyted current method. The energy of activation for conduction, the mobility and concentration of the charge carriers and the density and depth of the traps were found. It is shown that in polymers containing a conjugated double bond system there are traps grouped about fundamental trapping level.

Study of the electrophysical properties of polymers containing a conjugated double bond system (PCSs) involves great difficulty because impurities exert a considerable effect on electrical properties. Structural defects give rise to trapping levels and these affect electrical conductivity substantially. Investigation of polymers by the space charge-limited conduction (SCLC) method is therefore very useful, because the SCLC routine is sensitive to such characteristics of a dielectric as the energy of activation for conduction, the mobility and concentration of the charge carriers, the density of trapping levels and their possible distribution with respect to energy. The SCLC method is used successfully for investigation of inorganic semiconductors and dielectrics [1–3]. At the same time the number of papers in which this method is used for study of organic compounds, particularly polymers, is much smaller [4, 5].

The aim of the work described here was to determine a number of electrophysical characteristics of PCSs and their possible relationship with structure.

The materials chosen for study were polymers of diphenylbutadiyne (PDPB) and tolan (PT), prepared in the presence of anionic catalysts, and also thermally polymerized polytolan (PTT-300) [6, 7]. The molecular weights of the polymers were 2190, 880 and 960 respectively. Dark SCLC measurements with a Teralin III electrometer, were carried out in a measuring cell with insulation of resistance $R_0 = 10^{16}$ ohm. The precision of thermostatic control of the measurement cell was $\pm 0{\cdot}3°$ and the relative error of measurement of the current was 6%. The test specimens were in the form of sandwich cells on metal supports of silvered brass. The cathode was a layer of indium, obtained by vacuum deposition at 5×10^{-5} torr. For

* Vysokomol. soyed. **A19**: No. 7, 1454–1459, 1977.