ON THE NATURE OF TRANSITIONS IN POLYMETHAPHENYLENE-ISOPHTHALAMIDE*

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THE problem of producing heat-resistant polymers, particularly polyamides, is very urgent as modern industry requires polymeric materials of increasingly higher practical thermal stability. It is well known that the introduction into the polyamide chain of aromatic nuclei makes it possible to increase the melting point [1]. In the majority of cases, however, this method does not always give the required result: the polymer solubility in available solvents deteriorates and the melting point is near to or exceeds the decomposition temperature. All this makes processing into fibres, films and plastics practically impossible. To this type of polymer belongs, for example, polyamides synthesized from paraphenylenediamine and terephthalyl chloride, etc. [2].

Polymetaphenyleneisophthalamide (phenylone) is an exception among these polymers. Regardless of the fact that this polymer is fully aromatic, it can be comparatively easily processed into plastics, films and fibres. The practical thermal limit of stability of this polymer is approximately 260°. The study of phenylone is of theoretical interest since the elucidation of all of its unusual properties and the study of related polymers, on securing sufficient experimental data, will make it possible to synthesize various polymers with increased practical thermal stability. This study also has practical interest, as investigation of the nature of transitions in phenylone made it possible to select correctly the processing temperature of phenylone into plastic and determine the temperature of heat treatments which cause a marked change in the properties of plastics, films and fibres.

SPECIMENS AND EXPERIMENTAL METHODS

Unfractionated polymer obtained by emulsion polycondensation [3] was used in the investigation, in the form of powder with an intrinsic viscosity in sulphuric acid of over 1·0 and a moisture content of approximately 5%. A thermo-mechanical study was carried out in an automatic device which is described in detail in reference [4] on specimens subjected to a pressure of 600 kg/cm² at 310°. It was established by an X-ray method that the specimens obtained by hot pressing are amorphous. The rate of heating the specimens when obtaining the temperature/deformation curves was approximately 2 degrees/min. Loads ranging

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