

**STUDIES ON PHENOLIC RESINS :
AN ELECTRO-ANALYTICAL APPROACH**

BY

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IN MEMORY OF

MY MOTHER

CERTIFICATE

This is to certify that the thesis entitled "STUDIES ON PHENOLIC RESINS : AN ELECTRO-ANALYTICAL APPROACH" being submitted by Mr. P.S. Viswanathan to the Indian Institute of Technology, Delhi, for the award of the Degree of Doctor of Philosophy of the Indian Institute of Technology, Delhi, is a record of bonafide research work carried out by him under my supervision and to my knowledge it has reached the standard fulfilling the requirement of the regulations relating to the degree.

The results contained in this thesis have not been submitted in part or in full to any other University or Institute for the award of any degree or diploma.

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ABSTRACT

Two types of phenolic resins - novolac and resols were prepared. The novolac was crosslinked with hexamethylene tetramine (HMT) in different ratios. Novolac allyl ether was prepared by allylating the novolac. Phenol was sulphonated to get phenol sulphonic acid. This was then condensed with formaldehyde to get the resin. Metal salts like Zn^{2+} and Fe^{2+} of sulphonated resins were obtained by exchanging the resin with the respective metal salt solutions. These samples were pyrolysed to get pyrolytic products. Cresol formaldehyde was prepared by condensing p-cresol with formaldehyde.

Two types of poly phenylene sulphide were prepared by homo poly condensation of thiophenol. Also thiophenol formaldehyde was prepared by condensing thiophenol with para formaldehyde.

All these samples were characterised by different analytical techniques like IR, DTA/DSC, TGA etc.

The various electrical properties like conductivity, dielectric constant and loss were measured and thermally stimulated depolarization studies were made on these samples as a function of temperature, humidity, frequency and duration of

the applied voltage, and different conditions of preparation. An attempt has been made to correlate the distinct features observed during these measurements to different physical and chemical changes occurring in the polymer matrix. The various results are discussed in detail.

Thus, the prospects of using 'electro analytical techniques' for polymer characterisation have been analysed. These techniques can be complementary to the more established techniques like spectroscopic and thermal methods of analysis, and will be particularly useful in the study of thermosetting resins.

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