STUDIES OF ELECTRET EFFECT IN PLASTIC MATERIALS

Vinod Kumar Jain

Thesis submitted to Indian Institute of Technology, Delhi
for partial fulfilment of the Degree of
Doctor of Philosophy

1970

ACKNOWLEDGEMENTS

The author wishes to express his deep sense of gratitude to Dr. P.K.C. Pillai for kindly suggesting the problem and for valuable guidance.

Thanks are also due to Professor M.S. Sodha for encouragement and inspiration during the course of this investigation. The author also wishes to express his sincere appreciation for the help rendered by Mrs. Malti Goel, Mr. K.G. Balakrishnan and Mr. Brijesh Kuma: The assistance of Mr. S.L. Aneja for typing the thesis is also acknowledged.

The financial assistance, given by the Council of Scientific and Industrial Research, Govt. of India, is gratefully acknowledged.

P R E F A C E

Investigations of electret effect opens a new way of studying the mechanism of polarisation and absorption of charges in amorphous and crystalline dielectrics. Practical applications of electrets depend upon their surface charge characteristics. Different type of studies on the properties of electrets have been made by many workers in this field. But so far no satisfactory explanation has been given to explain the complete mechanism of electret. This may be due to the lack of detailed and systematic investigations of various properties of electrets. The properties of electrets are mostly depending upon the material used for the preparation and also upon the polarising conditions under which they are fabricated.

This thesis comprises of five chapters, describes the electret effect in polyvinyl chloride, SR_8, SR_{10} (PVC made with different compositions), polyvinyl acetate (BDH) and boswellia glabra (plant product). The chemical and physical properties of boswellia glabra are not known completely. The first chapter contains the brief survey of earlier work and also a review of various explanations suggested for this effect. In the second chapter, a critical review of the techniques for the fabrication and also the details of surface charge measurement of the electret are given. Details of a new method for fabrication of electrets developed by the author,

which is simple, quick and very convenient for plastic materials has also given in this chapter. This chapter also includes measurement techniques for the surface charge, dielectric constant and dielectric loss of electrets.

Chapter III is divided into six sections. First section deals with the study of surface charge characteristics at different polarising fields. The effect of polarising temperature on the behaviour of electrets is given in the second section. A damaging treatment of electrets was also studied and presented in this section. The third section contains the study of contact electrification at different temperatures and also with different electrode materials (Al, Cu, steel, molybdenum and tantalum). The studies of change in dielectric constant and dielectric loss of electrets of these materials are given in section four of this chapter. Surface charge, dielectric constant, dielectric loss and contact electrification studies in boswellia glabra are presented in section five of this chapter. Sixth section contains the details of the variation of dielectric constant and dielectric loss and also X-ray studies in boswellia glabra and mixture of carnauba wax and boswellia glabra electrets.

Chapter IV deals with the photoelectret studies in boswellia glabra. For the polarisation and measurement of the sample, an instrument was designed and developed by the author, in which heat, light and field can be applied on

the sample simultaneously. In this, the sample can be kept under the desiccated condition during fabrication and measurements.

Chapter V deals with the discussion and conclusion of the whole work. The references are listed at the end of the thesis.

Part of the work, presented in the thesis has resulted in the following publications:

1. Characteristics of Plastic Electrets, V.K. Jain and P.K.C. Pillai, Phys. Stat. Sol., 28, 415 (1968).

2. Effect of Polarising Temperature on the Characteristics of SR$_{10}$ Vinyl (PVC) Electrets, P.K.C.Pillai, V.K. Jain and G.K. Vij, Elect. Chem. Soc. (USA), 116, 837 (1969).

3. Investigations of Boswellia Glabra Electret, P.K.C.Pillai and V.K. Jain, J. Appl. Phys., 40, 3487 (1969).

4. Temperature Dependence of PVC and Polyvinyl Acetate Thermoelectrets, P.K.C. Pillai and V.K. Jain, J. Phys. D: Appl. Phys., 3, 1-10 (1970).

5. Review of the Various Techniques Used for the Measurement of Surface Charge and Discharge Current of Electret, P.K.C. Pillai and V.K. Jain, Accepted for publication in J. Sci. Ind. Res.

6. Investigations of the Variations of Dielectric Constant and Surface Charge of Polyvinyl Chloride Electrets with Time, P.K.C. Pillai, V.K. Jain and Meenakshi Kamdar, Accepted for Publication in J. Elect. Chem. Soc. (USA).

7. Investigations of Electret Effect in Plastic Materials, P.K.C. Pillai and V.K. Jain, Presented in a Symposium of IIRE (1968).

8. Investigation of Photoelectret Effect in Boswellia Glabra, P.K.C. Pillai, V.K. Jain and K.G. Balakrishnan, Communicated to J. Appl. Phys. (USA).

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