SRI V. S. SIVALINGAM CHETTIAR GOVERNMENT DEGREE COLLEGE (A)

Department of Physics

B.Sc. Honours with Research in Physics (2026 Batch)

Student Research Projects Report

Research Project Title: NaBr-Doped PVA/PVP Blend Polymer Films for Enhanced Optical and Electrical Performance in Solid-State Applications

As part of the B.Sc. Honours with Research in Physics curriculum, the student successfully completed and submitted a research-based project work titled "**Structural, Optical and Electrical Properties of NaBr Doped PVA/PVP Blend Polymer Films.**"

The project focuses on the synthesis of sodium bromide (NaBr) doped Polyvinyl Alcohol (PVA)/Polyvinyl Pyrrolidone (PVP) blend polymer films and a detailed investigation of their structural, optical, dielectric, and electrical transport properties.

The study is academically significant because PVA/PVP blend systems offer excellent film-forming ability, mechanical flexibility, and ion-hosting characteristics, while NaBr doping enhances ionic mobility, amorphous phase formation, and charge transport behavior. Such systems are highly promising for solid polymer electrolytes, supercapacitors, sensors, and low-cost energy storage devices.

This work strongly supports the department's emphasis on materials research, interdisciplinary experimentation, and energy-oriented physics applications.

1. Research Objectives

The major objectives of the project work were:

- To prepare NaBr doped PVA/PVP blend polymer films using solution casting technique.
- To study the structural properties and amorphous nature of the blend films.
- To analyze the optical absorption and optical band gap behavior.

- To investigate the electrical conductivity enhancement due to NaBr doping.
- To evaluate the effect of salt concentration on polymer–ion interactions.
- To assess the suitability of the films for solid-state electrolyte and energy device applications.
- To develop student skills in polymer synthesis, characterization, and scientific documentation.

2. Methodology Adopted

The student followed a systematic and research-oriented methodology consisting of:

- Extensive literature survey on polymer blend electrolytes, salt doping, and ion transport mechanisms.
- Selection of analytical-grade PVA, PVP, and NaBr in optimized weight ratios.
- Preparation of polymer blend solution using distilled water under controlled heating and magnetic stirring.
- Gradual incorporation of NaBr dopant at different concentrations to study concentration-dependent behavior.
- Solution casting and slow solvent evaporation to obtain uniform, free-standing flexible films.
- Film thickness measurement and sample conditioning before characterization.
- Characterization using XRD, FTIR, UV–Visible spectroscopy, dielectric analysis, impedance/DC conductivity studies, and SEM (where available).
- Correlation of amorphous nature with conductivity enhancement and optical band gap tuning.
- Comparative analysis of doped and undoped films to establish the role of NaBr.
- Scientific report writing, result discussion, and viva-voce presentation.

3. Project-Wise Academic Relevance

This project has strong relevance in the following areas:

- Polymer Physics
- Condensed Matter Physics
- Materials Science

- Solid State Ionics
- Electrochemical Energy Storage Systems

The research supports emerging developments in solid polymer electrolytes, ionic conductivity enhancement, and next-generation energy storage materials.

4. Learning Outcomes Achieved

Through the completion of this project, the student was able to:

- Gain practical knowledge in polymer blend film preparation.
- Understand the role of salt doping in modifying polymer properties.
- Learn advanced material characterization techniques.
- Improve experimental, analytical, and data interpretation skills.
- Apply physics principles to functional materials research.
- Develop scientific writing and project presentation competence.
- Enhance readiness for higher studies and research in materials and energy physics.

Conclusion

The project on NaBr doped PVA/PVP blend polymer films significantly strengthened the student's understanding of polymer blend engineering, ion transport physics, structural disorder, and functional material optimization**.**

The observed improvements in amorphous nature, optical response, and electrical conductivity indicate the potential applicability of these films in solid-state batteries, electrochemical cells, dielectric devices, and flexible electronics**.**

The ongoing work is expected to substantially contribute to the department's student research publications pipeline, innovation ecosystem, experimental learning practices, and academic quality enhancement initiatives.