

CHARACTERIZATION OF PROTON CONDUCTING PVDF-HFP/PEMA BLEND BASED SOLID ELECTROLYTES

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ABSTRACT

Proton conducting poly(vinylidene fluoride-cohexafluoropropylene)/polyethyl methacrylate (PVDF-HFP/PEMA) blend based electrolytes with different compositions of $\text{NH}_4\text{CF}_3\text{SO}_3$ salt have been prepared and characterized. XRD and SEM studies show that the addition of $\text{NH}_4\text{CF}_3\text{SO}_3$ helps to generate more amorphous region in the semicrystalline PVDF-HFP/PEMA system. The conductivity of the blend based electrolyte system increases with increasing content of $\text{NH}_4\text{CF}_3\text{SO}_3$. The system containing 40 wt % of salt exhibits the highest room temperature conductivity of $6.90 \times 10^{-4} \text{ S cm}^{-1}$. The temperature dependence of ionic conductivity of the system follows an Arrhenius behavior. The frequency dependence of conductivity of the system obeys the universal power law, $\sigma(\omega) A\omega^n$. The pre-exponent, n is found to decrease with increasing temperature suggesting that the Correlated Barrier Hopping model can be used to explain the conduction mechanism in the system.

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REFERENCES

- [1]. A. Bozkurt and W. H. Meyer (2001). Proton conducting blends of poly(4-vinylimidazole) with phosphoric acid. *Solid State Ionic*, **138**, 259-265.
- [2]. J. C. Lassegues, J. Grondin, M. Hernadez and B. Maree (2001). Proton conducting polymers blends and hybrids organic inorganic materials. *Solid State Ionic*, **145**, 37-45.
- [3]. M. Hema, S. Selvasekerapandian, A. Sakunthala, D. Arunkumar and H. Nithya (2008). Structural, vibrational and electrical characterization of PVA- NH_4Br polymer electrolyte system. *Physica B*, **403**, 2740-2747.
- [4]. A. M. M. Ali, N. S. Mohamed and A. K. Arof (1998). Polyethylene oxide (PEO) - ammonium sulfate ($(\text{NH}_4)_2\text{SO}_4$) complexes and electrochemical cell performance. *Journal of Power Sources*, **74**, 135-141.
- [5]. C. S. Ramya, S. Selvasekarapandian, T. Savitha, G. Hirankumar and P. C. Angelo (2007). Vibrational and impedance spectroscopic study on PVP- NH_4SCN based polymer electrolytes. *Physica B*, 393, 11-17.
- [6]. S. Rajendran, R. Subadevi and M. Nirmala (2004). Characterization of PVA-PVDF based solid polymer electrolytes. *Physica B*, 348, 73-78.
- [7]. A. Bhide and K. Hariharan (2007). Ionic transport studies on (PEO)₆:NaPO₃ polymer electrolyte plasticized with PEG 400. *European Polymer Journal*, 43, 4253-4270.
- [8]. C. S. Ramya, S. Selvasekarapandian, T. Savitha, G. Hirankumar, R. Baskaran, M. S. Bhuvaneshwari and P. C. Angelo (2006). Conductivity and thermal behavior of proton conducting polymer electrolyte based on poly (N-vinyl pyrrolidone). *European Polymer Journal*, 42, 2672-2677.

- [9]. S. D. Druger, A. Itzan, and M. A. Ratner (1983). Dynamic bond percolation theory: A microscopic model for diffusion in dynamically disordered systems. I. Definition and one-dimensional case. *Journal of Chemistry Physics*, 79, 3133-3142.
- [10]. A. M. Abo El Ata, S. M. Attia and T. M. Meaz (2004). Ac conductivity and dielectric behavior of $\text{CoAl}_x\text{Fe}_{2-x}\text{O}_4$. *Solid State Sciences*, 6, 61-69.
- [11]. A. Ghosh (1990). Frequency-dependent conductivity in bismuth-vanadate glassy semiconductor. *Physical Review*, B 41, 1479-1488.
- [12]. R. Ondo-Ndong, G. Ferblantier, F. Pascal-delannoy, A. Boyer and A. Fourcaran (2003). Electrical properties of Zinc Oxide sputtered thin films. *Microelectronics Journal*, 34, 1087-1092.
- [13]. A. R. Long (1982). Frequency-dependent loss in amorphous semiconductors. *Advance in Physics*, 31, 553-637.
- [14]. L. J. Meng, M. Andritschky and M. P. Dos Santos (1994). Zinc Oxide films prepared by dc reactive magnetron sputtering at different substrate temperatures. *Vacuum*, 45, 19-22.
- [15]. D. Deger and K. Ulutas (2004). Conduction and dielectric polarization in Se thin films. *Vacuum*, 72, 307-312.
- [16]. S. R. Elliot (1987). A.C. conduction in amorphous chalcogenide and pnictide semiconductors. *Advanced Physics*, 36, 135-218.
- [17]. P. Dutta, S. Biswas, M. Ghosh, S. K. De and S. Chatterjee (2001). The dc and ac conductivity of polyaniline–polyvinyl alcohol blends. *Synthetic Metals*, 122, 455-461.