Title: Preparation of Poly(vinyl alcohol)/Poly(ethylene oxide) Membranes Using Zinc Oxide as Functional Filler for Solid Electrolyte Applications in Zn-air Battery

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ABSTRACT

In this study, ion-conducting alkaline solid polymer electrolyte membranes (ASPE) were prepared from a poly(vinyl alcohol)/poly(ethylene oxide) blend in a mass ratio of 9:1 (PVA:PEO). The PVA cross-linking with glutaraldehyde and the addition of zinc oxide filler were studied. The prepared membranes were immersed in 7 M KOH solution prior to investigating their physicochemical, mechanical, and ionic conductivity properties. Impedance measurement revealed that the highest ionic conductivity achieved was 4.2×10^{-2} S cm^{-1} for PVA/PEO/8 wt% ZnO at room temperature. Fourier transform infrared (FTIR) spectroscopy confirmed the chemical interaction between glutaraldehyde (GA) and PVA/PEO. This cross-linking enhances the mechanical strength and stability to alkaline solution of the membrane, ensuring improved durability and resistance to structural deformation under operational conditions. Scanning electron microscopy (SEM) images revealed that at 8% ZnO content, the zinc oxide particles were uniformly and evenly distributed throughout the membrane. This homogeneous dispersion contributed to the formation of a porous structure, facilitating ion transport and improving the overall performance of the membrane. The uniform distribution of ZnO also played a crucial role in

enhancing the mechanical stability and electrochemical properties of the polymer electrolyte membrane.