INFLUENCE OF γ- RADIATION ON ELECTRICAL AND DIELECTRICAL PROPERTIES OF $AgPO_3$ GLASS

M. K. El-Mansy, F. Salman and H. Hazza
Faculty of Science at Benha, Zagazig University, Egypt.

The dielectric parameters ε' and ε'' and the electrical conductivity of both virgin and γ-irradiated $AgPO_3$ glass studied in the temperature range 300K-500K and the frequency range 50Hz-500KHz. The results illustrate a decrease of the dielectric constant ε' and an increase of dielectric loss ε'' as the γ- radiation dose is increased. The bulk conductivity and the relaxation process were studied using Z' - Z'' impedance plots. The data suggest the ionic conduction with activation energy lying in the range 0.23-0.26 eV. The activation energy is found to increase with increasing γ-radiation dose. The dipolar relaxation in $AgPO_3$ is found to be thermally activated with activation energy lying in the range 0.54-0.60 eV for virgin and γ-irradiated glasses. The analysis implies a reasonable value of phonon frequency in the range $(3.2 \times 10^{13} - 4 \times 10^{14})$ sec^{-1}. The results are discussed on the basis of the diffusion of silver ions in $AgPO_3$ glass.

Introduction

The electrical and dielectrical properties of $AgPO_3$ glass have been widely investigated in recent years in the search for solid electrolytes with superionic properties (1, 2, 3, 4). The mechanism of electrical conduction in silver ion-containing glass is useful for understanding the localized thermally activated diffusion of molecules, ions and / or ion pairs that is known to occur within a rigid disordered matrix of a variety of solids (5).

The complex permittivity of silver phosphate glass has been measured in the temperature range 200-400k, and frequency range $12-10^5$ Hz (5). Two relaxation processes occur within the glass. Both are observed in the electrical modulus spectrum but only the low-temperature, or faster, process is attributed to the motion of Ag^+ ions that form ion pairs with the phosphate chains whereas slower is due to the local motions of the chain segments. Both indicate the presence of loosly packed regions in the disordered matrix.