

HIGH METHACRYLATES COPOLYMERS AS MATRICES OF SOLID ELECTROLYTES FOR LITHIUM POWER SOURCES

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The actual problem for producing of lithium-containing solid electrolytes (SPE) with high ionic conductivity is known to be an application as matrices of polymers with a needed complex of physico-chemical properties. Copolymers of hexyl methacrylate (HMA) or octyl methacrylate (OMA) with acrylonitrile (AN) in block with molar ratio 1:1, 1:2, 1:3 and 1:4 correspondingly were synthesized by us. The influence of monomers ratio on characteristics of relaxation processes was studied and dielectrical parameters dependencies for copolymer films from LiClO₄ salt concentration were found. For modeling SPE values of ionic conductivities (σ) were found. Due to the presence in macromolecules HMA and OMA units they are more movable and more flexible then copolymers of butyl methacrylate with acrylonitrile. For synthesized copolymers only one α -process is observed on tg δ curve. With increasing of a content of the hard component (acrylonitrile) absolute values of tg δ diminish and maximum shifts to higher temperatures. Increasing of LiClO₄ concentration in films of copolymers-matrices from 5 to 15 % (by weight) leads to an increase of tg δ_{\max} value and $T_{\text{tg}_{\max}}$ shifts to higher temperatures.

Such changes of dielectric parameters can be explained by the reinforcement of the intermolecular interaction, caused by a complex-formation among lithium cations (Li⁺) and electron pair on nitrogen atoms in AN and oxygen atoms in HMA and OMA molecules [1-2]. Such complexes are oriented in electrical field by different ways therefore on relaxation curves tg $\delta = f(T)$ a shoulder is observed for copolymers doped by lithium perchlorate. By using of dielectrical data values of the effective ionic conductivity of SPE films were calculated. Curves of the dependence σ from a salt concentration have maximum at LiClO₄ content 10 % (weight) from copolymers masses OMA-AN (1:2 and 1:3).

On measurements data by the impedance method for obtained by us SPE the ionic conductivity is sufficiently high $10^{-7} - 10^{-5}$ S/cm. So that due to good film-forming properties, low glass temperatures, hydrophobicity such copolymers can be used as matrices for obtaining of solid polymer electrolytes in lithium chemical power sources.

References

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