Improved ionic conductivity of lithium-zinc-tellurite glass-ceramic electrolytes

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Abstract	An enhancement in the secondary battery safety demands the optimum synthesis of glass-ceramics electrolytes with modified ionic conductivity. To achieve improved ionic conductivity and safer operation of the battery, we synthesized Li2O included zinc- tellurite glass-ceramics based electrolytes of chemical composition (85-x)TeO2.xLi(2)O.15ZnO, where x = 0, 5, 10, 15 mol%. Samples were prepared using the melt quenching method at 800 degrees C followed by thermal annealing at 320 degrees C for 3 h and characterized. The effects of varying temperature, alternating current (AC) frequency and Li2O concentration on the structure and ionic conductivity of such glass-ceramics were determined. The SEM images of the annealed glass-ceramic electrolytes displayed rough surface with a uniform distribution of nucleated crystal flakes with sizes less than 1 mu m. X-ray diffraction analysis confirmed the well crystalline nature of achieved electrolytes. Incorporation of Li2O in the electrolytes was found to generate some new crystalline phases including hexagonal Li-6(TeO6), monoclinic Zn2Te3O8 and monoclinic Li2Te2O5. The estimated crystallite size of the electrolyte was ranged from approximate to 40 to 80 nm. AC impedance measurement revealed that the variation in the temperatures, Li2O contents, and high AC frequencies have a significant influence on the ionic conductivity of the electrolytes. Furthermore, electrolyte doped with 15 mol% of Li2O exhibited the optimum performance with an ionic conductivity approximate to 2.4 x 10 (7) S cm (1) at the frequency of 54 Hz and in the temperature range of 323-473 K. This enhancement in the conductivity was attributed to the sizable alteration in the ions vibration and ruptures of covalent bonds in the electrolytes network structures. (C) 2017 The Authors. Published by Elsevier B.V. This is an open access article under the CC BY-NC-ND license.
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