Sustainable and Ecological Materials: Sodium-Ion Conducting Solid Electrolytes for Solid-State Rechargeable Batteries

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Abstract. A severe level of pollution by materials has started to change our climate, significantly affecting our earth, including our living bodies. Therefore, researchers are looking for sustainable and ecological materials for manufacturing and industrial applications. A solid-state rechargeable battery is an electrochemical cell that stores and generates electric energy. A fast ion-conducting solid electrolyte is a crucial component that acts as a separator between the positive and negative electrodes of a cell. In the paper, we have reviewed the electrical conductivity of sodium-ion conducting solid electrolytes. The sodium compounds are non-toxic and ecological materials available globally and cheaply. Additionally, batteries with sodium ions are similar to those with lithium ions in cell configuration and energy density; however, they are more sustainable and ecological. We have also discussed the electrical transport properties of poly(ethylene oxide)$_x$–disodium terephthalate solid polymer electrolyte, where an organic salt, disodium terephthalate, contains two sodium ions per molecule for transport. The composition, x, varied from infinity to 8 in mole ratio to optimize the electrical conductivity of the electrolyte.

Keywords: Batteries · Sodium ions · Solid electrolytes · Solid polymer electrolytes · Disodium terephthalate · Electrical conductivity

1 Introduction

Our earth is facing severe pollution problems because of the vast and uncontrolled use of resources. The previous extensive and unchecked extraction of minerals from ores has resulted in extreme water, soil, and air pollution. Heavy industries are also enhancing pollution. The use of petroleum-based products, such as plastics, gasoline, and diesel, further increases this pollution. Pollution has started to change our climate, which is so severe that it is killing living bodies. We are, therefore, considering sustainable and ecological materials to save the earth and its people.

Currently, petrol or diesel is the fuel of choice for light and heavy motor vehicles, which produces harmful greenhouse gases. The world is promoting electric vehicles (EVs) powered by electric motors with high-energy-density rechargeable batteries to reduce greenhouse gases to zero by the year 2060. A single-cell rechargeable battery

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