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Review on Provision of Solid-state Polymer Electrolytes for Electrochemical Energy Storage Devices

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Abstract
Solid-state electrochemical energy storage (EES) development has recently attracted considerable attention due to their practical application in portable energy devices. One of the issues with recent portable energy devices is high cost and adverse environmental effects during production, mainly brought on by the rise of the stationary applications. The electrochemical performance and mechanical stability of devices during charge/discharge are generally influenced by the design and method of synthesis, especially on the development of solid-state polymer electrolytes (SSPEs). The present review provides an overview of the solvent-free process used to make solid-state polymer electrolytes (SSPEs) and its challenges. Four methods are described: solution casting technique, heat-based method (hot-pressing and melt processing), spin coating, and 3D printing. Despite being the most recent approach for creating SSPEs, 3D printing is still a bottleneck for all-printed batteries and is still intensively studied. Hot-pressing and melt processing were employed as approaches for not only SSPEs preparation but also for electrodes preparation. Solution casting is the most straightforward approach to produce flexible and transparent SSPEs compared to the other three methods. Due to its convenience, many researchers have chosen this approach to prepare their SSPES. The solution was homogeneously placed onto a flat substrate and spread using a spin coater, which can be rotated at varying rotation speeds to generate a uniform film. This procedure is similar to the solution casting technique. The solution viscosity, spinning time, and spin coater speed all influence how thick the final coating is (production). Lastly, the challenges for SSPEs preparation development in EES devices are outlined.

Keywords: Solvent-free method; Solid-state polymer electrolytes; Heat-based method; Spin coating; 3D printing; Solution casting technique.